Outcome Evaluation and Indicative Impact Assessment of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) work on Measuring, Reporting and Verification (MRV)

Working Paper No. 364

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Tonya Schuetz
Allison Poulos

CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS

Working Paper

Outcome Evaluation and Indicative Impact Assessment of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) work on Measuring, Reporting and Verification (MRV)

Working Paper No. 364

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

Tonya Schuetz
Allison Poulos

To cite this working paper
Schuetz T, Poulos A. 2021. Outcome Evaluation and Indicative Impact Assessment of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) work on Measuring, Reporting and Verification (MRV). CCAFS Working Paper no. 364. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

About CCAFS working papers
Titles in this series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

About CCAFS
The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is led by the International Center for Tropical Agriculture (CIAT), part of the Alliance of Bioveristy International and CIAT, and carried out with support from the CGIAR Trust Fund and through bilateral funding agreements. For more information, please visit https://ccafs.cgiar.org/donors.

Contact us
CCAFS Program Management Unit, Wageningen University & Research, Lumen building, Droevendaalsesteeg 3a, 6708 PB Wageningen, the Netherlands. Email: ccafs@cgiar.org

Abstract

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), through its Flagship on Low-Emissions Development—otherwise known as Flagship 3 (FP3)—seeks to address the increasing challenge that global warming is placing on agricultural practices, policies and measures and the overall challenge of declining food security. CCAFS was established in 2010 as a cross-cutting program of the 15 CGIAR Research Centers and strategic partnerships. For the past decade, CCAFS has been working intensively on, among other things, low-emissions development (LED) and mitigation. Before the closure of its second phase in December 2021, the program has commissioned an evaluation of progress towards impact, particularly around the work packages on measuring, reporting, and verification (MRV) with a rough investment of USD 2.4 mil. over ten years. The evaluation methods included a stakeholder survey and an adaptation of Contribution Analysis (Mayne 2013) and Outcome Harvesting (Wilson-Grau, Britt 2013) to develop a narrative of CCAFS' contributions to MRV impacts. We complemented this with an analysis to calculate estimated benefits and impact benefits in GHGE reductions, people's wellbeing and hectares affected.

The survey helped to identify the top three clusters of MRV outputs and provide evidence of impact, followed by interviews to understand the impacts in more depth. CCAFS' influence, at a qualitative minimum, on primary target countries was confirmed by interviewees for China, Colombia, Ethiopia, Kenya, and Vietnam. While MRV improvements clearly contribute to improved quantification of emissions for mitigation planning and implementation, there is no reliable way to quantify and link these to mitigation outcomes, other than to indicate the significance of the agricultural emissions from each country, which we have done here. Our

findings indicating early impact can serve as pointers and follow-up quantitative evaluative analytical work. In our evaluation results, we include analysis and interpretation of FAOSTAT data and some quantifications towards the System Level Outcome (SLO) target indicators.

The delivery model, hinging on strategic partnerships involving government champions, research expertise, and South-South countries knowledge exchange, was viewed as successful in the selected countries where we received confirmation from partners and government affiliated key informants. Seven harvested outcomes are presented in Annex VII as individual cases per country and specific MRV work. The overview of results and findings from the key informant interviews illustrate the demand-driven delivery of innovative products and processes required for the MRV work evolution to yield the desired impacts.

The results strongly support evidence of how CCAFS work over the past ten years on MRV has successfully introduced the right mechanisms and incentives to support the achievement of FP3 goals and higher-level global climate-related targets. The work in strong partnerships has developed a series of tools, approaches, networks for exchange and sharing across countries, and capacity in key positions, champions in governments, research, and South-South collaborations to support and enable the continuous improvement of MRV criteria that are critical to achieving the CCAFS Program and CGIAR system-level set targets, and ultimately the Sustainable Development Goals (SDGs) and commitments of the Paris Agreement. These outcomes are solid starting points upon which to follow-up in a few years to substantiate the changes and obtain further refined quantified impacts as they gradually mature and as more next users make use of CCAFS MRV innovation products and materials.

Keywords

Agriculture; climate change; food systems; food security; measuring, reporting, and verifying; climate change mitigation.

About the authors

Tonya Schuetz, (coordinating author) Performance, Innovations, Strategic Analysis for Impact (PISA 4 Impact) Program, the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) Email: tonya.rawe@care.org

Allison Poulo, Performance, Innovations, Strategic Analysis for Impact (PISA 4 Impact) Program, the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT)

Acknowledgements

This outcome evaluation and indicative impact assessment was conducted as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from the CGIAR Trust Fund and through bilateral funding agreements. For details, please visit https://ccafs.cgiar.org/partners.

We are grateful to all the key informants and survey respondents who participated both the survey and interviews that underpin this review. We appreciate the guidance and backstopping provided for the evaluation by the CCAFS Flagship 3 team, Lini Wollenberg, Ciniro Costa Junior, and Arun Khatri-Chhetri. We acknowledge Olga Spellman (The Alliance of Bioversity International and CIAT) for English editing of this report.

Contents

Acronyms 1

1. Introduction 4

2. Methodology 6

Step 1: Setting out the attribution problem to be addressed—evaluation design 6

Step 2: Developing a theory of change and identifying related risks 7

Step 3: Gathering existing evidence on the theory of change—engaging with informants to harvest and verify outcomes 10

Step 4: Assembling and assessing the contribution story and its challenges 12

Step 5: Seeking out additional evidence—data analysis, interpretation and synthesis 14

Step 6: Support future use of findings 14

3. Results 15

3.1 Overview of survey results 15

3.2 Overview of Harvested and Evidenced Outcomes 19

3.3 Country GHG emissions and mitigation targets 26

4. Lessons learned 32

5. Conclusions 34

Annex I. Terms of Reference for the Evaluation 41

Annex II. List of MRV Resources 47

Annex III. Survey questions 49

Annex IV. Survey results (detailed) 54

Annex V. List of Key Informants 66

Annex VI. Country-specific Harvested Outcomes 67

Annex VII. List of MRV Evidence Submitted 87

References 92

Acronyms

AFOLU	Agriculture, Forestry and Other Land Use
BUR	Biennial update report
CAAS	Chinese Academy of Agricultural Sciences
CAC	Central American Agricultural Council
CCAC	Climate and Clean Air Coalition
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIAT	International Center for Tropical Agriculture
CLIFF-GRADS	Climate Food and Farming - Global Research Alliance Development Scholarships
COP	Conference of Parties
DFI	Dairy Farming Institute (Nestlé)
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária / The Brazilian Agricultural Research Corporation
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Global Food and Agriculture Statistics of FAO of the United Nations
FP3	Flagship on Low-Emissions Development, otherwise known as Flagship 3
GANSO	Ganadería Sostenible (NGO, Colombia)
GHG	Greenhouse gas
GRA	Global Research Alliance for Agricultural Greenhouse Gases
Gt CO2-e yr^{-1}	Giga tons of carbon dioxide equivalents per year
ha	Hectares
IAE	Institute for Agricultural Environment, Ministry of Agriculture and Rural Development (Vietnam)

IAMC	Integrated Assessment Modeling Consortium
IDEAM	The Institute of Hydrology, Meteorology and Environmental Studies (Columbia)
IDOs	Intermediary development outcomes
IEDA-CAAS	Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences
IIASA	International Institute for Applied Systems Analysis
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute (CGIAR)
KCSAP	Kenya Climate-Smart Agriculture Project
L-ADG	Livestock Activity Data Guidance
LED	Low-emissions development
LFSDP	Livestock and Fisheries Sector Development Project (Ethiopia)
MADR	Ministerio de Agricultura y Desarrollo Rural (Colombia)
MADS	Ministerio de Ambiente y Desarrollo Sostenible (Colombia)
MAFF	The Ministry of Agriculture, Forestry and Fisheries (Japan)
MapAWD	Mapping suitability of the Alternate Wetting and Drying
MARD	Ministry of Agriculture and Rural Development (Vietnam)
MRV	Measuring, Reporting and Verifying
NAMA	Nationally Appropriate Mitigation Action
NARES	National Agricultural Research Organization
NARIGP	The National Agricultural and Rural Inclusive Growth Project (Kenya)

NCSC	National Center on Climate Change Strategy and International Cooperation
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
OFLP	Oromia Forested Landscape Program (Ethiopia)
OICR	Outcome Impact Case Report
SAMPLES	Standard Assessment of Agricultural Mitigation Potential and Livelihoods
SDGs	United Nations' Sustainable Development Goals
SECTOR	Source-selective and Emission-adjusted GHG CalculaTOR for Cropland
SLO	System-Level Outcome
SRF	Strategy and Results Framework 2016-2030
UNFCCC	United Nations Framework Convention on Climate Change
UNIQUE	UNIQUE Forestry and Land Use GmbH
USAID	United States Agency for International Development
USDA EC-LEDS	United States Department of Agriculture Enhancing Capacity for Low-Emission Development Strategies
USFS	United States Forest Service

1. Introduction

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) seeks to address the increasing challenge global warming is placing on agricultural practices, policies and measures and the overall challenge of declining food security. CCAFS was established in 2010 as a cross-cutting program of the 15 CGIAR Research Centers and strategic partnerships.

CCAFS aims to produce research for development in five target regions of low- and middle-income countries and globally to enhance agriculture and food security in the context of climate variability, climate change and uncertainty about future climate conditions. The program is carried out with funding support from governments, aid agencies, and other partners through the CGIAR Trust Fund and bilaterally. The program is structured into four programmatic work areas called Flagships: 1) Priorities and Policies for Climate-Smart Agriculture; 2) Climate-Smart Technologies and Practices; 3) Low-Emissions Development (LED); and 4) Climate Services and Safety Nets.

According to the United Nations Framework Convention on Climate Change (UNFCCC) "Handbook on Measurement, Reporting and Verification for developing country Parties", the principles of measurable, reportable and verifiable (MRV) were established in the Bali Action Plan, which was adopted at the Convention of the Parties (COP) 13 in 2007, and also includes the framework for greenhouse gas (GHG) mitigation actions and commitments (UNFCCC 2014). This framework contains the Nationally Appropriate Mitigation Actions (NAMAs), for many developing countries, placing an emphasis on agriculture—where the core of the economic activity lies—which provides the best strategy for mitigation. NAMAs support the Intended Nationally Determined Contributions (INDCs) and are specific to the needs of the country. Accordingly, CCAFS' LED work builds on what over 100 countries indicated in their INDCs as their GHG emissions reduction targets from the agriculture sector. Credible MRV of emissions and emissions reductions is critical to helping national policy makers understand sources of GHGs, develop mitigation strategies, improve transparency, and gain access to climate-related finance.

The purpose of this evaluation is to assess the impact of the LED Flagship, referred to as Flagship 3 (FP3), specifically the research on measuring, reporting, and verifying GHG emissions from agriculture during the period 2010 to 2020. As the CCAFS program draws to a close in 2021, these findings also serve to document FP3's achievements and the lessons learned.

Despite agriculture's mitigation potential, the evidence and capacity to support LED in agriculture at large scales remains weak. High uncertainty and limited data from the developing world constrain reliable GHG emissions estimates. **FP3's vision has been that LED will reduce agricultural GHG**

emissions while ensuring food security at large scales. Research has provided the guidance underpinning LED technical packages, monitoring, incentives, trade-offs, and enabling conditions.

One of FP3's focal areas is quantifying GHG emissions from smallholder systems to improve the reliability of GHG emissions estimates for smallholder mitigation practices through measurement and modelling. These results are intended to help Identify priorities and options for low-emissions development and in turn provide the foundation for larger-scale action. Together with CGIAR Centers and key partners, FP3 has worked on improving MRV to support project and national-level accounting for mitigation, especially for the livestock, rice, and agroforestry sectors.

2. Methodology

We combined qualitative evaluation approaches with a quantitative analysis in our assessment of FP3 impact. Both methods were strongly based on a theory of change approach. We adapted steps of Contribution Analysis and Outcome Harvesting to develop a narrative of CCAFS' contributions to MRV impacts and complemented this with an analysis to estimate benefits in GHG emissions reductions, people's wellbeing and hectares covered.

Step 1: Setting out the attribution problem to be addressed—evaluation design

CGIAR has adopted an ambitious Strategy and Results Framework (SRF) 2016-2030 that aims to help achieve a set of global goals, including the United Nations Sustainable Development Goals (SDGs) by 2030. In Phase 2 of its funding (2017-2022), CCAFS was designed to contribute directly to several System-Level Outcomes (SLOs) promoted in the SRF (see table 1).

Table 1. Relevant CGIAR targets for System-Level Outcome 3 (Improved natural resources systems and ecosystems services) and CCAFS Flagship 3 target contributions by 2022

CGIAR system level Outcome 3: Improved natural resources systems and ecosystems services (SLO target No.)	CGIAR target by 2022	CGIAR target by 2030	CCAFS FP3 target by 2022	SDG reference*
Increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse (7)	5%	20%	20 initiatives in 5-8 countries	6.4.1 6.3.1
Reduction of agriculturally related GHG emissions compared with business-as-usual scenario in 2022 (8)	0.2 Gt CO_2-e yr^{-1} (5%)	0.8 Gt CO_2-e yr^{-1} (15%)	0.16 Gt CO_2-e yr^{-1} (4%)	13.2.1 13.3.1 13.3.2
Hectares (ha) degraded land area restored (9)	55 m	190 m	0.8 m (1.45% of CGIAR target)	15.3.1
Hectares (ha) of forest saved from deforestation (10)	2.5 m	7.5 m	0.8 m (32% of CGIAR target)	15.1.1

Source: Data compiled from CGIAR Strategy and Results Framework 2016-2030 (pp. 5)
*SDG Indicators were updated in April 2021 after this table was included in the ToR of the evaluation. The text for 13.2.1 and 13.3.1 has been modified, and still fit, while 13.3.2 has been removed

The questions this evaluation tried to address and substantiate are the following:

1. What were the outcomes and impacts or impact indications of CCAFS research work on MRV? What was reported with regards to GHG emission reductions, hectares covered, and farmers

implementing the improved technologies? What was reported in terms of changes in policies and capacity developed, and specific innovations?

2. Why have these results occurred? Has the program influenced the observed results? Has the program made an (important) contribution to the observed changes and results?
3. What roles did the CCAFS MRV work play? Is it reasonable to conclude that the program has made a difference?
4. What does the preponderance of evidence say about how well the program is making a difference?
5. What conditions are needed to make this type of program succeed?
6. What quantifications can be made with the findings from the above questions if the contribution of the program can be verified?

Step 2: Developing a theory of change and identifying related risks

The CCAFS MRV theory of change shown in Figure 1 is the tailored, simplified impact pathway structure that has underpinned CCAFS MRV implementation towards achievement of impact over the past decade. Figure 1 shows how CCAFS MRV-generated research products, tools, information platforms and events for nine cluster areas of work led to changes in national MRV systems, especially changes from Tier 1 to Tier 2 estimates of emissions, which can be confirmed through the national GHG emission inventories. The desired impacts from these national inventories were set up to contribute to the GHG emissions reduction targets of the SLOs, as listed in Table 1. The delivery model (Figure 1) to achieve these ambitious changes has leveraged strategic partnerships and networks that bring together experts in research with government champions and international organizations, like the GRA and FAO, and supports knowledge exchange between South-South national governments. This collaboration ensures demand-driven research that can inform policies, investments and decision-making.

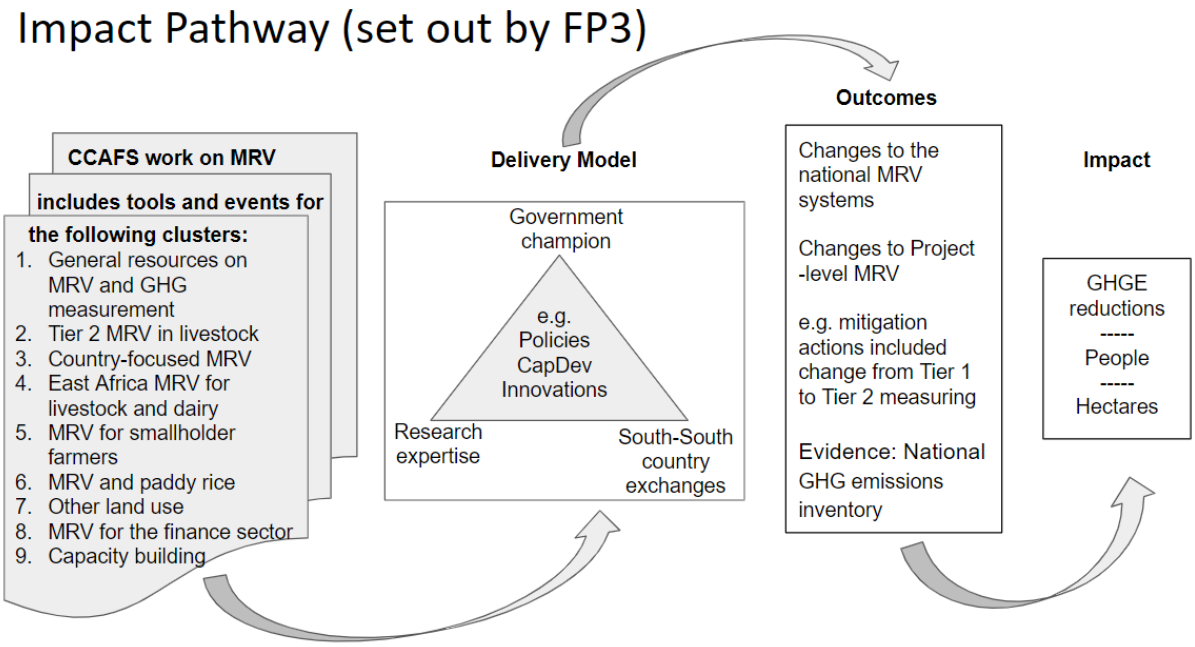


Figure 1. Flagship 3 impact pathway for its MRV work.

The underlying **assumptions** are that achieving this objective will (i) help developing countries more accurately plan and transparently track NDCs and meet their obligations under the Paris Agreement (Article 13); (ii) increase access to finance for LED (including carbon projects), and (iii) mainstream LED in the investment operations of financial institutions (e.g., World Bank). Additionally, it is assumed that the delivery model (i.e., building networks and working with selected champions), successfully enables the desired changes in national MRV systems and that the global agenda translates into national government-supported implementation plans.

At the outset of Phase II (2016), the CCAFS program was set with nested theories of change for the delivery of its overall program and its individual flagships. In the context of this exercise, each flagship and region committed to specific targets towards selected intermediary development outcomes (IDOs) and sub-IDOs. Both the IDOs and sub-IDOs are a breakdown of the higher-level SLOs and proxy indicators for progress towards impact. For Flagship 3 these are shown in Table 2.

Table 2. CCAFS target setting for Flagship 3.

SLOs, IDOs, and sub-IDOs	2022 Outcome Description	Target					
		2017	2018	2019	2020	2021	2022
SLO: Reduced poverty							
IDO: Increased incomes and employment							
Sub-IDO: More efficient use of inputs	20 agricultural development initiatives where CCAFS science is used to target and implement interventions to increase input efficiency	3	6	10	12	15	20
SLO: Improved natural resource systems and ecosystem services							
IDO Natural capital enhanced and protected, especially from climate change							
Sub-IDO: Land, water and forest degradation (including deforestation) minimized and reversed	0.8 million hectares targeted by research-informed initiatives for restoring degraded land or preventing deforestation	0.1	0.2	0.2	0.5	0.6	0.8
Crosscutting IDO on Mitigation and adaptation achieved directed (directed at natural resources SLO and poverty SLO)							
Sub-IDO: Reduced net GHG emissions from agriculture, forests and other forms of land use	10 low emissions plans developed that have significant mitigation potential for 2030, i.e. will contribute to at least 5% GHG reduction or reach at least 10,000 farmers, with all plans examined for their gender implications	1	2	3	6	8	10
Crosscutting IDO on Equity & inclusion achieved (directed at natural resources SLO and poverty SLO)							
Sub-IDO: Participation in decision-making	15 organizations adapting their plans or directing investment to increase women's participation in decision-making about LED in agriculture	4	6	8	10	12	15
Crosscutting IDO: National partners and beneficiaries enabled (directed at natural resources SLO and poverty SLO)							
Sub-IDO: Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	15 policy decisions taken (in part) based on engagement and information dissemination by CCAFS	1	2	4	8	12	15

Source: CCAFS proposal p. 119

We identified three challenges and risks that needed to be addressed for this evaluation:

- CCAFS FP3 work on measurement needs to be translated into its implications for GHG emissions reduction to assess the CGIAR System Level Outcome Targets.
- CCAFS can only claim it makes contributions through the highly collaborative nature of its work in strong partnerships. Attributional claims can only be made for the partnership.
- Capturing impacts at multiple unit-levels and scales of impact, like national and subnational, project impacts, emissions/ha vs. emissions/kg, is a necessity. Since the MRV work in

countries and regions has been staggered across a range of emissions factors and different commodities, e.g., rice, livestock, forests. This complicates the comparison and aggregation of findings.

Despite these challenges, this evaluation aimed to capture findings of the status of delivery against the targets by the end of 2020. This would indicate whether the program has put the right mechanisms in place and built capacity where needed to inform decisions that will ultimately lead to achieving the desired and targeted impacts by 2030.

Step 3: Gathering existing evidence on the theory of change—engaging with informants to harvest and verify outcomes

We started with existing evidence from CCAFS' annual monitoring of its MRV outputs, including a series of training events, knowledge exchanges, and continuous expansion of CCAFS tools and methods. Box 1 presents the wealth of MRV-related outputs, clustered into nine thematic groups. We identified participants' contacts by cross-referencing the events, workshops, trainings, and knowledge exchanges of South-South countries with research, government champions and international organization participants. We sent a survey to these contacts to collect evidence to test our theory of change. We provided examples of MRV Resources and explored what evidence contacts and key partners could provide and share (see Annex III for the survey questions. The list of survey contacts can be provided upon request).

Box 1. List of MRV Resources created by CCAFS and partners between 2010 and 2021

Cluster 1 - General resources on MRV and GHG measurement

- MRV Platform for Agriculture website
- Standard Assessment of Agricultural Mitigation Potential and Livelihoods - SAMPLES website, SAMPLES publications, SAMPLES methods

Cluster 2 - Tier 2 MRV in livestock

Workshops and publications related to improving Tier 2 MRV of livestock:

- **Report**: Livestock activity data guidance
- **Report**: Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement
- **Brochure**: Livestock development and climate change: the benefits of advanced greenhouse gas inventories
- **Resource portal**: Tier 2 inventory approaches in the livestock sector: A collection of agricultural greenhouse gas inventory practices
- Expert workshop with the GRA, 17-18 Jul. 2018 the Hague, Improving activity data for Tier 2 estimates of Livestock Emissions: Dealing with Data Gaps

- Expert workshop with GRA and FAO, 20-21 Feb. 2017 Rome, Making MRV Work. Workshop on implementing MRV to meet countries' mitigation and sustainable development goals in the livestock sector

Cluster 3 - Country-focused MRV

- Colombia on the RUMINANT model
- Potential mitigation contribution from agroforestry to Vietnam's Nationally Determined Contribution
- Vietnam's livestock feed database and tool (USDA EC-LEDS)
- Kenya on livestock emissions by the GRA and UNIQUE
- Ethiopia MRV development for livestock emissions, facilitated by UNIQUE
- China: Carbon Footprint Assessment and Mitigation Options of Dairy under Chinese Conditions and Tier 2 MRV of livestock emissions in China: Developing Guidance for Implementation at the Provincial Level

Cluster 4 - East Africa MRV for livestock and dairy

- Gold Standard smallholder dairy methodology
- **Article**: Central Kenya smallholder dairy GHG baseline survey and the methods working paper
- **Article**: Pasture urine and dung emissions
- **Tool**: Cattle activity data similarities calculator
- **Article**: Improved emission factors for enteric fermentation

Cluster 5 - MRV for smallholder farmers

- Smallholder emissions workshops with FAO-MICCA
- Reducing the costs of GHG estimates in agriculture to inform low emissions development (#1), CCAFS-FAO 10-12 Nov 2014 Rome
- Quantifying Agricultural Greenhouse Gases in Developing Countries (#3), CCAFS-FAO-MICCA- Duke University. Apr. 2012
- Smallholder Mitigation: Whole Farm and Landscape Accounting (#4), CCAFS-FAO-MICCA expert workshop, 27-28 Oct 2011, Rome
- Towards a Framework for Smallholder Agricultural Mitigation (#6), CCAFS-FAO-MICCA 13 July, 2010
- Environmental Research Letters Special issue "Focus on Improving Quantification of Agricultural Greenhouse Gases," with Duke University

Cluster 6 - MRV for paddy rice

- SECTOR (Source-selective and Emission-adjusted GHG CalculaTOR for Cropland) GHG calculator for paddy rice emissions, see also article on SECTOR methodology (2019)
- Handbook of Monitoring, Reporting, and Verification for a Greenhouse Gas Mitigation Project with Water Management in Irrigated Rice Paddies (2018)
- Guidelines for Measuring CH_4 and N_2O Emissions from Rice Paddies by a Manually Operated Closed Chamber Method, Version 1 (2015)

Cluster 7 - Other land use

- MRV of Agroforestry

- Making trees count: Measurement and reporting of agroforestry in UNFCCC national communications of non-Annex I countries
- Counting tree contributions

Cluster 8 - MRV for the finance sector

- Green bond certification criteria: Climate Bonds Initiative Agriculture Criteria
- Webinar: Soil carbon MRV and finance

Cluster 9 - Capacity building

- CLIFF or CLIFF-GRADS PhD research fellowship programs

Step 4: Assembling and assessing the contribution story and its challenges

The survey helped us to identify key informants to be interviewed about the evidence of change generated by CCAFS' contribution. Our interviews with key informants were conducted with the help of a MRV expert from FP3 to ensure that a subject matter specialist could assess the credibility of the claim and double-check the specificities of the result chains. Only in some cases did we have the opportunity to substantiate and verify statements through government officials. However, since the changes were documented in specific national policies, like NDCs, we focused on verifying CCAFS' contributions along the timeline and events that led up to the finalization of the national documents.

The questions for the key informant interviews were defined as follows:

- Has your country improved its MRV system?
- What was CCAFS' contribution to this improvement, if any?
- Which outputs, materials, what event(s)?
- Does your country's MRV have specified mitigation actions?
- If yes, have these mitigation actions been implemented?
- What evidence do you have to verify your statements?

From the interviews results we drafted outcome cases following a standard Outcome Template (see Box 2). We then shared back the drafts with the key informants for corrections and improvements before finalization (see Annex V. List of Key Informants).

Box 2. Outcome template

Outcome ID: Title

Outcome: Description in 3-5 sentences

Outcome type: linked to the clusters of MRV themes that were developed and provided by CCAFS in collaboration with the selected partners and networks (See Annex II: List of MRV Resources).

Contribution: What was CCAFS' contribution to the change?

- Cluster 1 - General resources on MRV and GHG measurement
- Cluster 2 - Tier 2 MRV in livestock
- Cluster 3 - Country-focused MRV
- Cluster 4 - East Africa MRV for livestock and dairy
- Cluster 5 - MRV for smallholder farmers
- Cluster 6 - MRV for paddy rice
- Cluster 7 - Other land use
- Cluster 8 - MRV for the finance sector
- Cluster 9 - Capacity building (Initiatives, e.g., starting a Non-governmental organization (NGO))

Relevance: Lead/Partnership/Catalytic

Societal Actors: Who has changed / was involved in making the change happen?

I. **Implementing partners*** (e.g., National Agricultural Research Organizations (*NARES), CARE, International Institute of Rural Reconstruction*)
- NARES
- Civil society organizations (national and local)
- International Non-Governmental Organizations

II. **Government authorities and agencies** (e.g., national governments, UNFCCC, World Food Programme of the United Nations, World Farmers' Organisation, CAADEP, CAC)
- UN bodies
- Politicians
- Officials

III. **Private**

IV. **Funding Agencies**

*May overlap with other categories

Geographic scope: primary country (link to/ spilled over to other countries)

Investment impacted by CCAFS:

Policy impacted by CCAFS:

MRV System Improvement:

Outputs:

Informants: those interviewed

Step 5: Seeking out additional evidence—data analysis, interpretation and synthesis

We selected a number of countries with which CCAFS has engagement through its project, regional and global MRV work. Using FAOSTAT agriculture data for country-level emissions, we estimated the GtCO2 emissions in 2018 from the selected countries and identified the percentage of the global agriculture emissions. According to the Integrated Assessment Modeling Consortium IAMC 1.5°C Scenario Explorer (Huppmann et al 2019), hosted by the International Institute for Applied Systems Analysis (IIASA), an emissions reduction of 24% by 2030 and 50% by 2050 (from 2020 levels) is a mitigation pathway compatible with the target to limit global warming below 1.5°C (IPCC, 2018). From this we drew conclusions of the selected countries' contributions to the targets by 2030 and 2050 and linked these back to the CCAFS targets from Tables 1 and 2 (see Analysis from FAOSTAT on Selected Countries for more information and figures).

Step 6: Support future use of findings

The write-up of the harvested outcomes can be used for project reporting and for future evaluation work. It would be valuable to follow up on a number of leads in a few years' time to look for further changes and substantiation of the early changes this evaluation has identified. In order to make all the necessary materials and resources pertaining to this study available, we want to ensure that they are openly accessible, except for individuals' private data, whose information is stored by the Alliance to be revisited in a controlled and selective manner, e.g., by future evaluators and auditors. Future impact pathways and theories of change can be further revised and, where the additional evidence permits, contribute to strengthening the originally drafted impact pathway.

3. Results

3.1 Overview of survey results

The survey response rate was about 10% and we received valuable insights from 36 responses. Sixty-four percent of respondents had a current or past role with FP3, i.e., partners or recipients of the Climate Food and Farming - Global Research Alliance Development Scholarship (CLIFF-GRADs). See Annex IV for detailed survey results.

1. **Role of respondents' organizations**

Survey respondents' (shown in % in brackets) organizational affiliations fell into three different categories, and were allowed to select multiple choices (Figure 2):

- organizations that contribute to improving MRV [N= 27 (75%)];
- organizations that can take actions to reduce agricultural GHG emissions by supporting, a policy, program, action on farms, or other initiative [N=23 (64%)]; and
- organizations that are responsible for the measurement, reporting or verification of agricultural GHG emissions [N=12(33%)].

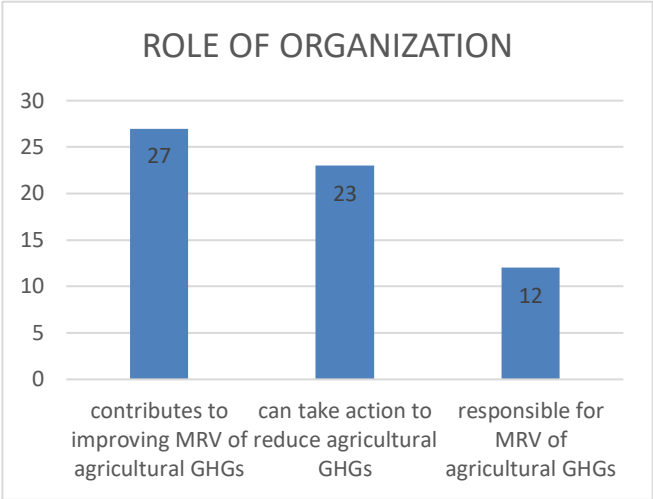


Figure 2. Role of respondents' organizations

2. **Type of Organization**

Slightly less than two-thirds of the respondents (58%) are affiliated with academia and research. Almost one-third (28%) are affiliated with government/ ministries. Eight percent of respondents indicated that they are affiliated with private sector/ business-type organizations, 3% of each of these organizations were affiliated with community-based organizations and intergovernmental bodies (Figure 3).

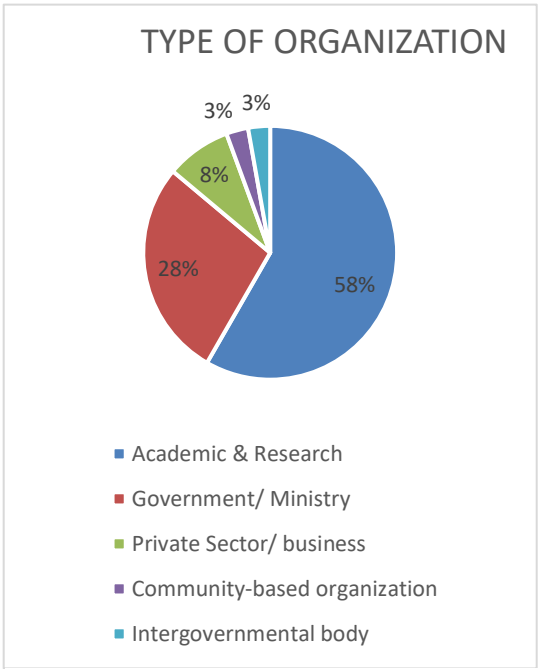


Figure 3. Respondents' type of organization

3. Knowledge about CCAFS

Ninety-two percent of respondents knew of CCAFS and 8% did not.

4. Awareness and evidence of impact of MRV work clusters

In their review of the resources produced by CCAFS with its partners that were attached to the survey (see Box 1), the survey respondents were most aware of and stated that they were able to provide evidence of impacts for three clusters of outputs (general resources, capacity building, and Tier 2 MRV in livestock), as shown in Table 3.

Table 3. Most-known and highest-impact clusters of MRV outputs among survey respondents

Cluster No. and short title	Awareness of respondents in %	Ability to provide evidence of impacts in %
1 - General resources	85	32
9 - Capacity building	84	23
2 - Tier 2 MRV in livestock	75	18

5. Changes observed linked to CCAFS MRV work

Based on the use of the CCAFS products and events, the survey respondents indicated that they observed the changes presented in Figure 4.

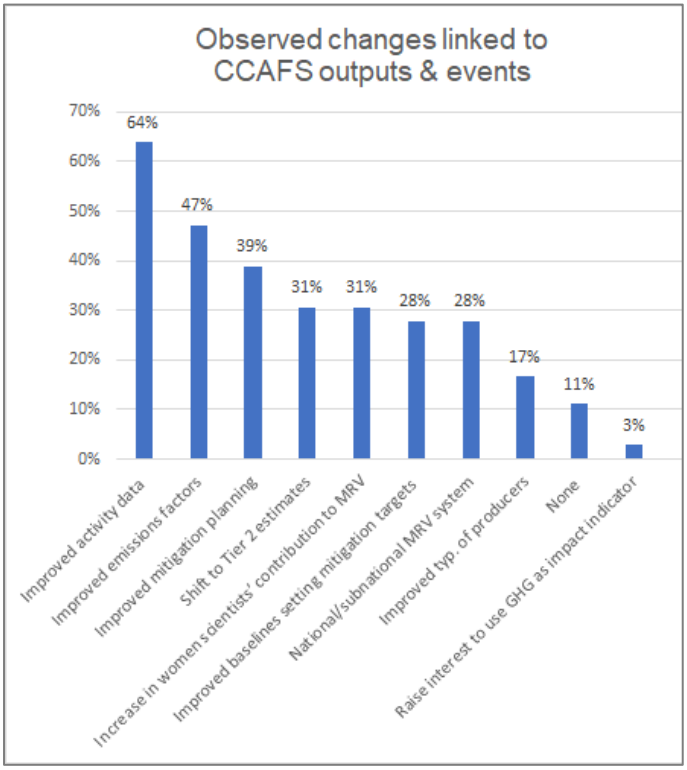


Figure 4. GHG mitigation impacts to identify

The top three highest-reported observed changes were: improved activity data (64%), improved emission factors (47%) and improved mitigation planning (39%). A shift to Tier 2 estimates and an increase in women's contribution to MRV both ranked as the next most-commonly reported changes (31%).

Countries where the most respondents indicated change to be observed were Ethiopia (33% of respondents), Kenya (24%), and Nigeria and Vietnam (both 9%).

6. MRV informed national GHG mitigation in agriculture

Two-thirds (66%) of the respondents indicated that MRV informed GHG mitigation in agriculture in their project/country. Those stating yes, indicated that they had projects in Ethiopia (36% = 9 mentions), Kenya (28% = 7 mentions), Vietnam (12% = 3 mentions), Indonesia (8% = 2 mentions), and China, France, Uruguay, and Zimbabwe (1 mention each).

7. CCAFS' contribution in primary target countries

Based on the GHG mitigation impacts addressed in the survey, respondents confirmed that CCAFS has made contributions in four of the five primary targeted countries: China, Ethiopia, Kenya, and Vietnam, at least qualitatively. There were no survey respondents from Colombia. This could be due to a language barrier since the survey was only provided in English.

8. Quantitative estimates

Quantitative estimates of (i) GHG mitigation in the agricultural sector potentially informed by improved MRV (Figure 5a), (ii) numbers of benefiting farmers (Figure 5b), and (iii) size of affected area (Figure 5c), show that it is still early days in all three impact areas, for which more than 50% of the responses were 'not yet', 'do not know', and 'does not apply'. However, 43% of the responses reported emissions reductions of over 100,000 mtCO_2 equivalent, 24% reported more than 100,000 farmers benefitting and 20% reported 100,000 or more hectares of area affected.

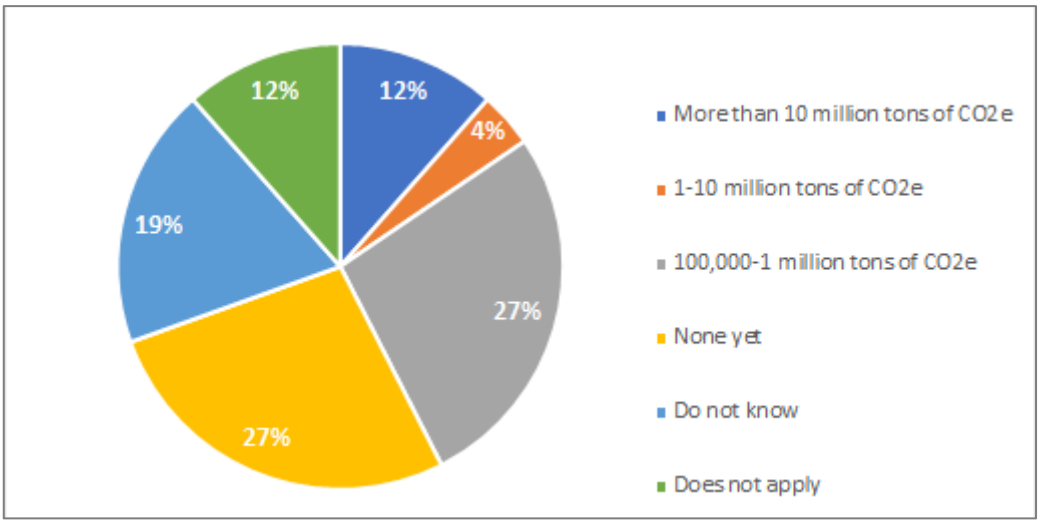


Figure 5a. Estimated level of GHG mitigation in the agriculture sector potentially informed by improved MRV to date (26 replies)

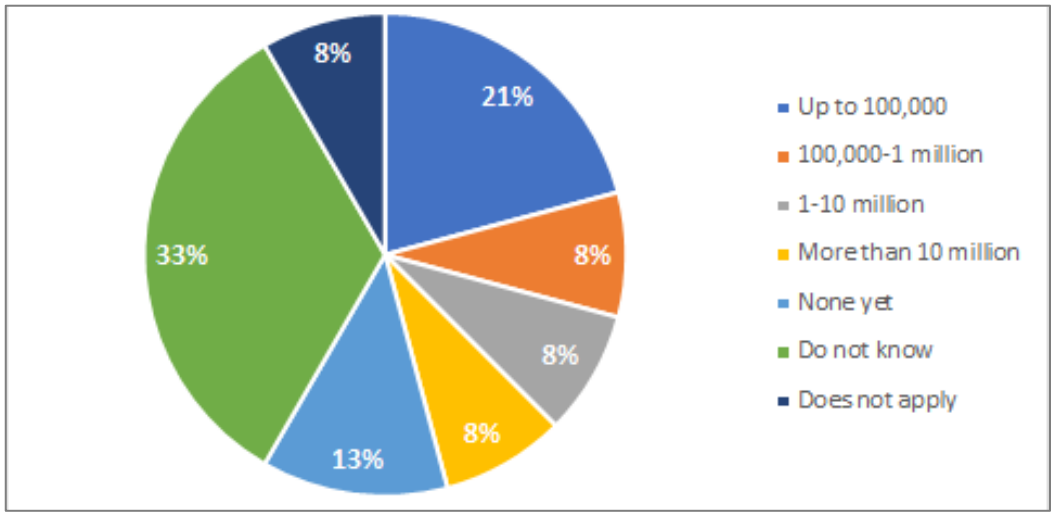


Figure 5b. Estimated number of benefiting farmers (24 replies)

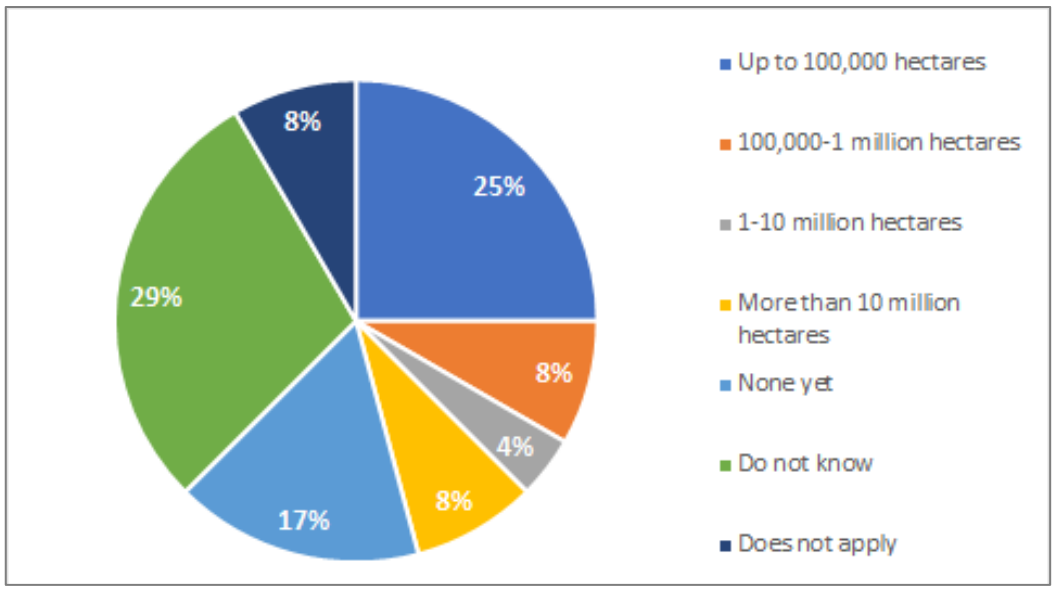


Figure 5c. Estimated size of area affected (24 replies)

9. Further analysis to quantify GHG emissions

Further analysis is necessary to understand the quantification of GHG emissions reductions, hectares covered, and farmers implementing the improved technologies. See Section 3, "Country GHG emissions and mitigation targets," for some complementary light-touch quantifications.

10. Evidence of impact

Twenty survey respondents who indicated that they had evidence of impact, or worked in a government or ministry, were contacted for an interview. Based on the information emerging from the surveys, 12 key informants were contacted for additional interviews.

11. Learning and looking ahead

In the last three questions of the survey, respondents shared their suggestions and views on what could be improved, what was successful, and next steps, which are summarized in Section 4. Lessons Learned.

3.2 Overview of Harvested and Evidenced Outcomes

12. The key informants' interviews produced seven harvested outcomes, which are presented in Annex VII as individual cases per country and the specific MRV work. This part of the results section provides an overview of the harvested outcomes and the evidence resulting from the interviews. These outcomes are good starting points for follow-up in a few years to substantiate the changes and arrive at further-refined quantified impacts as they gradually mature and as more next-users make use of CCAFS MRV innovation products and materials. Some of these have a huge potential and are significant.

13. Most of the informants and stakeholders have by now—after a decade of CCAFS research for development work on mitigation—become very close partners. In only a very few cases were we able to obtain external substantiation of the observed outcomes. However, some of the behavioral changes, such as NDCs or new investments, were evidenced in key documents. The summary findings are based on the informants' statements.

14. Figure 6 shows a historical timeline capturing informants' views of key outputs and events where CCAFS' MRV work contributed to significant changes in the selected countries. The changes are categorized as: (i) investments, (ii) policies, and (iii) MRV system improvement. Country and global outputs are also placed within this simplified MRV historical timeline. For clarity, it was not possible to include all relevant FP3 outputs; we therefore had to make a choice based on what the informants put forth.

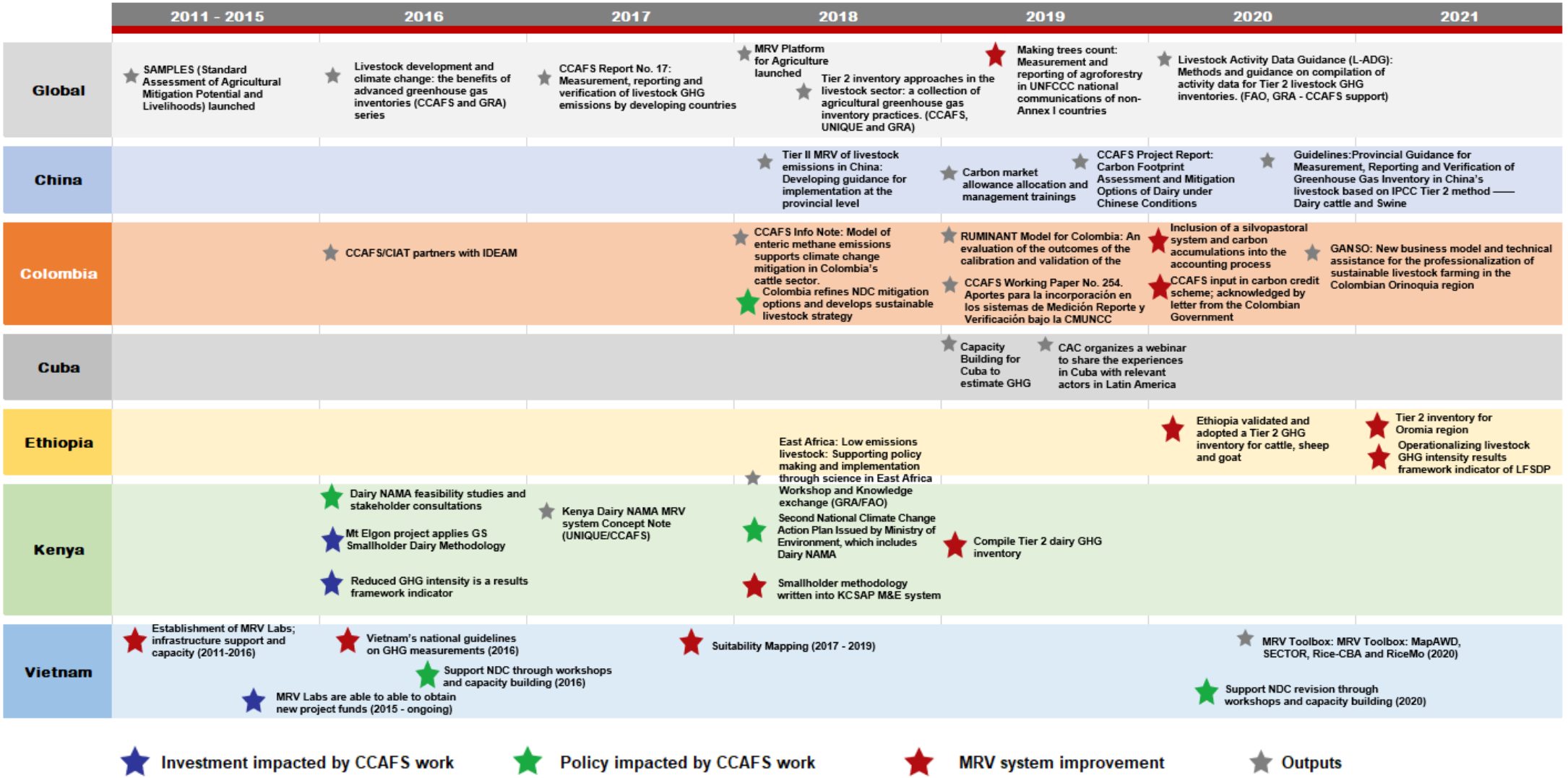


Figure 6. Timeline of outcomes and impacts linked to CCAFS' MRV work

15. In Table 4 the relevance of CCAFS' work and contribution is presented. In four of the outcome cases CCAFS was identified as a key partner in the achievement of the outcome. In two cases CCAFS was identified as the lead, and in one early case CCAFS' contribution was characterized as catalytic.

Table 4. Overview of CCAFS-related Outcomes—Relevance and Contribution

Country	Relevance	Contribution
Brazil	Catalytic	CCAFS and UNIQUE support for travel for Brazilian Agricultural Research Corporation (EMBRAPA) staff to COP22 (2016) and a Livestock MRV event hosted by FAO catalyzed increased interest for MRV initiatives in Brazil.
China	Partnership	CCAFS partnered with the Institute of Environment and Sustainable Development in Agriculture (IEDA) at the Chinese Academy of Agricultural Sciences (CAAS) to support the development of Tier 2 MRV guidance. CCAFS also provided capacity through the organization of workshops and trainings with international experts and provided support for publications and guidelines.
Colombia	Partnership	Through very close partnership with the Ministerio de Ambiente y Desarrollo Sostenible (MADS) and Ministerio de Agricultura y Desarrollo Rural (MADR), CCAFS/CIAT was able to test and launch a variety of initiatives in Colombia and support the transition from Tier I to Tier 2 reporting of GHG emissions and carbon sequestration, resulting in an improved national GHG inventory that acknowledges CIAT.
Cuba	Partnership	CCAFS provided expert advice to the Agriculture, Forestry and Other Land Use (AFOLU) sector in Cuba and capacity building, which helped the country transition from Tier 1 to Tier 2 reporting. Through a partnership between CCAFS and the Central American Agricultural Council (CAC), the information was shared with relevant actors in Latin America.
Ethiopia	Lead	CCAFS and UNIQUE have supported the Ethiopian Ministry of Environment in adopting the Tier 2 methodology, which will be used in calculating the national GHG inventory in Ethiopia's next submission to the UNFCCC. The Tier 2 data will also be incorporated into the NDC, and is mentioned in the NDC update.
Kenya	Lead	CCAFS and UNIQUE have been recognized for their contribution to the Kenyan Ministry of Agriculture, Livestock, Fisheries and Cooperatives' "Inventory of GHG emissions from dairy cattle in Kenya 1995-2017," through their support for adopting the Tier 2 methodology and validating the emission factors by using the Cattle Methane Similarity Matrix Calculator.

Vietnam	Partnership	CCAFS/ International Rice Research Institute (IRRI)—in partnership with the Ministry of Agriculture and Rural Development (MARD), —have scaled out MRV innovations, supported the NDC, and contributed to emission reductions through AWD.

16. Table 5 provides an overview of which CCAFS outputs (by cluster) contributed to countries' outcomes. For example, according to the survey responses, the CCAFS outputs from cluster Tier 2 MRV in livestock and country-focused MRV have contributed to outcomes in five countries. This is complemented in the second part of the table by the types of evidence available. See Annex VII for a list of MRV evidence that was submitted by survey respondents.

Table 5. Outcomes Overview—Evidence of CCAFS' MRV outputs (by cluster).*

CCAFS' Contributing Clusters of MRV Work	Brazil	China	Colombia	Cuba	Ethiopia	Kenya	Vietnam
1 General resources					X	X	X
2 Tier 2 MRV in Livestock		X	X		X	X	X
3 Country-focused MRV		X	X	X	X	X	
4 E Africa MRV livestock/dairy					X	X	
5 MRV for smallholder farmers			X		X	X	
6 MRV for paddy rice							X
7 Other land use				X	X	X	
8 MRV finance sector					X	X	
9 Capacity Building	X						X
Potential Evidence from survey to support impact							
Policy/ program/ project document		X	X		X	X	X
Published reports, briefs, info notes		X	X				X
Activity data and improved national GHG inventory			X		X		X
Update of MRV systems			X		X	X	X

Use of improved MRV system for NAMAs			X				X
Tier 2 GHG inventory (in press)					X		

*Information source: **Annex VII. Specific Outcomes**, and based on key informant interviews and survey results.

17. In Table 6 the selected countries' NDCs are listed and linked to the respective contribution by CCAFS, according to the key informants.

Table 6. Outcomes Overview - CCAFS' contributions to the NDCs

Country	NDC	CCAFS Contribution
Brazil	Brazil, 2020 and 2016	CCAFS support and resources helped EMBRAPA enhance MRV capacity for livestock and shape a livestock initiative in Brazil. Knowledge sharing and use of CCAFS knowledge products contributed to the launch of "carbon-free meat", a labeling initiative linked to livestock and emissions reduction in the private sector.
China	China, 2016 (under revision)	China's Ministry of Ecology and Environment partnered with CCAFS to develop provincial guidance for MRV relating to the livestock sector using Tier 2 methods. The guidelines were rolled out over seven training events with 1300 participants from government ministries and large farms to build capacity among provinces. The new MRV guidelines for the livestock sector support the implementation of China's NDC in the agricultural sector.
Colombia	Colombia, 2020 and 2018	CCAFS/CIAT has made key contributions in Colombia to support Tier 2 reporting, resulting in an improved national GHG inventory. A calibrated RUMINANT model helps to analyze the quality of feed and provide emission estimates in a cost-effective way.
Cuba	Cuba, 2020 and 2016	It is too early to provide evidence of CCAFS' contributions.
Ethiopia	Ethiopia, 2020 and 2017	Ethiopia validated and adopted a Tier 2 GHG inventory for livestock with support from CCAFS and UNIQUE, based on multiple outputs.
Kenya	Kenya, 2020 and 2016	Kenya adopted Tier 2 methods for dairy cattle with CCAFS support. The Cattle Methane Similarity Matrix Calculator was used to validate estimated emissions.
Vietnam	Vietnam, 2020 and 2016	CCAFS /IRRI and the Ministry of Agriculture and Rural Development contributed to evaluating mitigation options in paddy rice cultivation in Vietnam which supported improvements in their national GHG inventory, NAMA, and 2020 updated NDC.

18. Table 7 identifies the key **societal actors** that interviewees mentioned as having changed their behavior (knowledge, attitude, skills, relations, and practices). We categorized them

into four different types of societal actors, i.e., implementing partners, government, private sector actors, and funders.

Table 7. Outcomes Overview—behavior change in Societal Actors*

Country	Implementing Partners	Government	Private Sector	Funder
Brazil	EMBRAPA	Ministério da Agricultura, Pecuária e Abastecimento	Marfrig; UNIQUE	
China	Institute of Environment and Sustainable Development in Agriculture, CAAS; CCAFS	National Center on Climate Change Strategy and International Cooperation (NCSC)	Starbucks Co., Nestlé's Dairy Farming Institute	New Zealand Govt
Colombia	CIAT, CCAFS, DEAM	MADS, MADR		United States Agency for International Development (USAID)
Cuba	CIAT, CCAFS, Clima Soluciones	Cuban Government		USAID
Ethiopia	UNIQUE, CCAFS, WRI, GRA, World Bank, New Zealand Govt, FAO, Ethiopian Institute for Agricultural Research	Ethiopia Ministry of Environment		USAID; New Zealand Government; World Bank, US Forestry Service
Kenya	UNIQUE, CCAFS, GRA, World Bank, FAO	Kenya Ministry of Agriculture, Livestock, Fisheries and Cooperatives; New Zealand Government		New Zealand Government, USAID, World Bank, FAO
Vietnam	Institute for Agricultural Environment, Ministry of Agriculture and Rural Development in Vietnam (IAE), CCAFS, IRRI	IAE	UNIQUE	Climate and Clean Air Coalition (CCAC) (check MARLO), German Federal Ministry of Education and Research; The Ministry of Agriculture,

				Forestry and Fisheries (MAFF) of Japan

* Societal actors are the ones who changed in the course of the process.

19. Key informants reported evidence of **spillover effects,** where the work being carried out by the implementing partners in one country affected another country. See Figure 7 for reported spillover effects, which we categorized into three types: collaboration, dissemination, and transferal with examples.

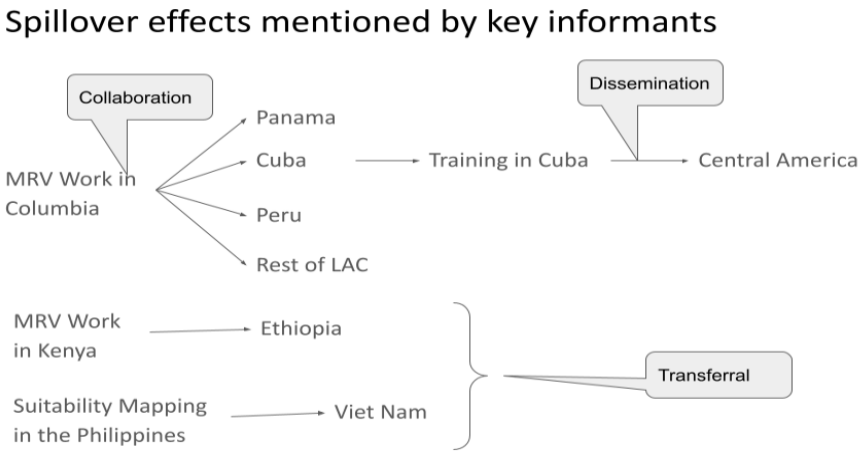


Figure 7. Spillover effects mentioned by key informants

20. These examples were explicitly mentioned and evidenced by key informants:

A. **Collaboration:** The work in Columbia was often implemented in collaboration with work being conducted in Cuba, Panama, Peru, and the rest of Latin America.

B. **Dissemination**: In Cuba, following a training event on how to estimate GHG emissions in the AFOLU sector, CCAFS teamed up with CAC to disseminate the information through a webinar that was aimed at supporting other Central American countries.

C. **Transferring experience:** Following positive results in Kenya, the experience was transferred to Ethiopia. Likewise, the suitability mapping that was developed for the

Philippines, was later transferred to Vietnam. In addition, there are a handful of materials that have been used in trainings by multiple countries:

- Livestock development and climate change: the benefits of advanced greenhouse gas inventories (CCAFS and GRA)
- CCAFS Report No. 17: Measurement, reporting, and verification of livestock GHG emissions by developing countries in the UNFCCC (CCAFS, 2017)
- Tier 2 inventory approaches in the livestock sector: a collection of agricultural greenhouse gas inventory practices. (Andreas Wilkes, Suzanne van Dijk - CCAFS, UNIQUE and GRA)
- Livestock Activity Data Guidance (L-ADG): Methods and guidance on compilation of activity data for Tier 2 livestock GHG inventories. (FAO, GRA 2020)

21. It is expected that more of these ripple or spillover effects will be registered in coming years as the use of materials becomes more evident.

3.3 Country GHG emissions and mitigation targets

3.3.1 Analysis from FAOSTAT on GHG emissions for selected countries

22. To better understand the relevance of the countries and the significance of their MRV towards GHG emission reductions, we examined the levels of emissions for six countries where CCAFS has had the most impactful engagement on MRV: China, Colombia, Cuba, Ethiopia, Kenya, and Vietnam. Using FAOSTAT country emissions for agriculture, we estimated that the countries emitted **0.912** $GtCO_2$ in 2018, which represents **17.1%** of global emissions from agriculture (Figure 8).

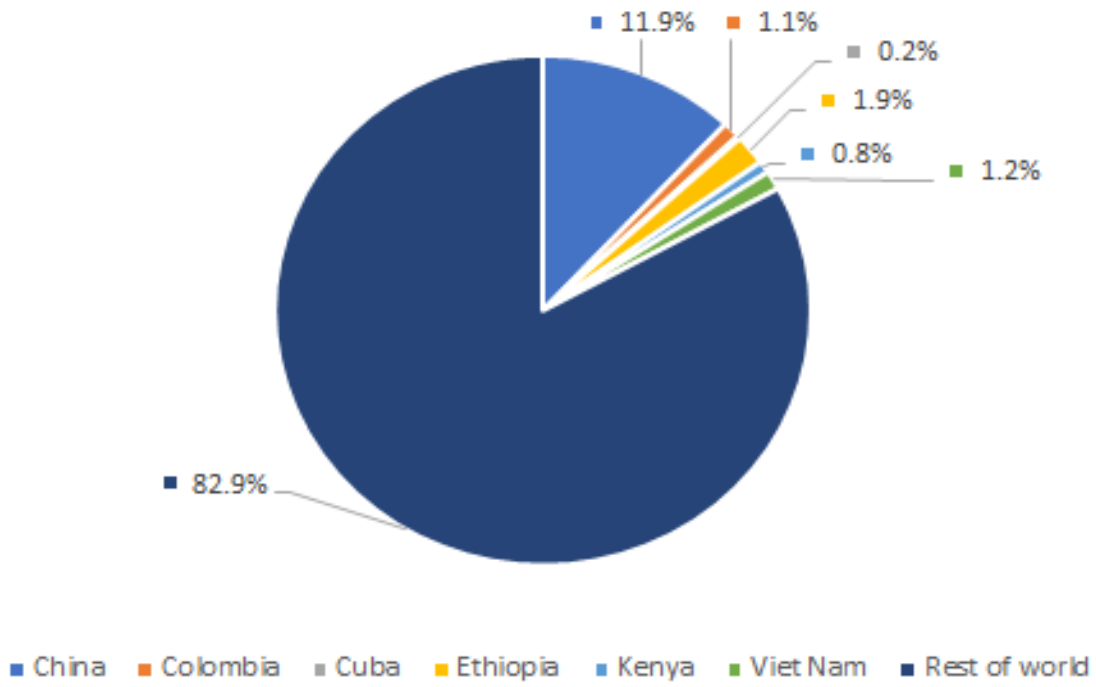


Figure 8. Agricultural GHG emissions from six selected countries as a percentage of total global GHG emissions

23. According to the IAMC 1.5°C Scenario Explorer, hosted by IIASA, an emissions reduction of **24% by 2030** and of **50% by 2050** (from 2020 levels forecast based on those for 2018) is a mitigation pathway compatible with the target of limiting global warming below 1.5°C (IPCC, 2018).

24. Figures 9a and 9b show emissions by country between 1990 and 2018, with projections towards achieving the 2030 and 2050 targets. Figure 9a includes all six selected countries, while Figure 9b shows selected countries except China, to make the trends for Colombia, Cuba, Ethiopia, Kenya, and Vietnam more clearly visible. The 2050 targets are the same and are often lower than 1990 levels; however, taking the total data from the selected countries indicates a slight decrease from 0.914 $GtCO_2$ in 2010 to 0.912 $GtCO_2$ in 2018, due to decreases in GHG emissions for China and Colombia. Comparing 2018 emissions to the 2030 targets, China is the country facing the biggest challenge of reducing its emissions by 0.153

$GtCO_2$, Ethiopia the second highest challenge at 0.025 $GtCO_2$, followed by Vietnam 0.015 $GtCO_2$, Colombia 0.014 $GtCO_2$, Kenya 0.010 $GtCO_2$, and lastly Cuba 0.002 $GtCO_2$.

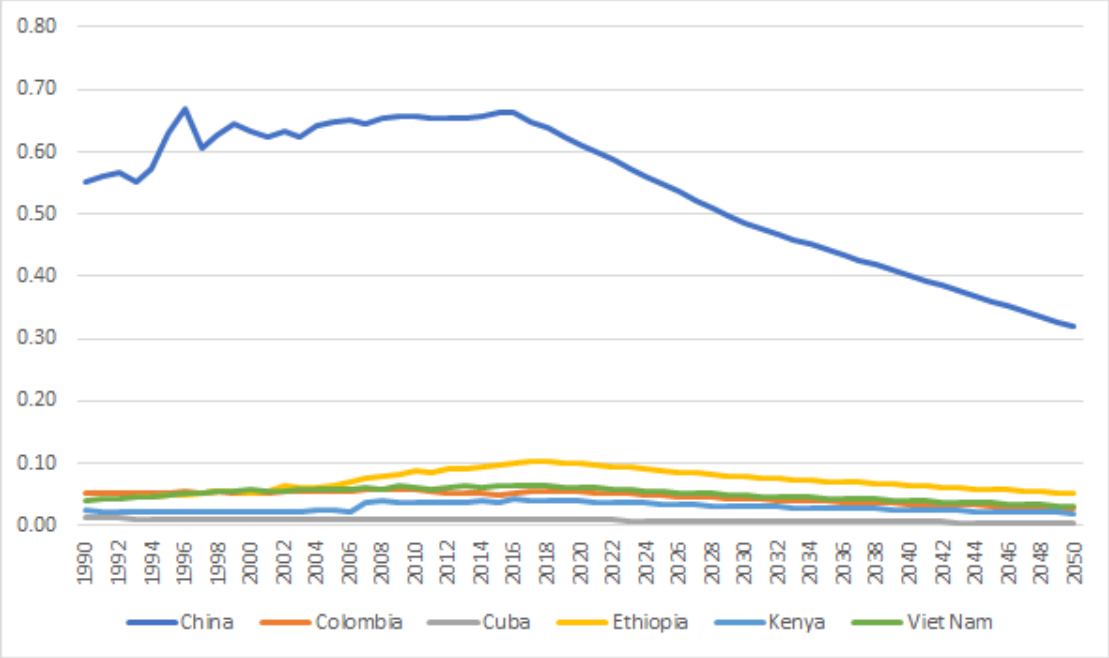


Figure 9a. Agricultural GHG emissions for China, Colombia, Cuba, Ethiopia, Kenya, and Vietnam. Expected reduction required by 2030 and 2050 to reach the 1.5°C climate target

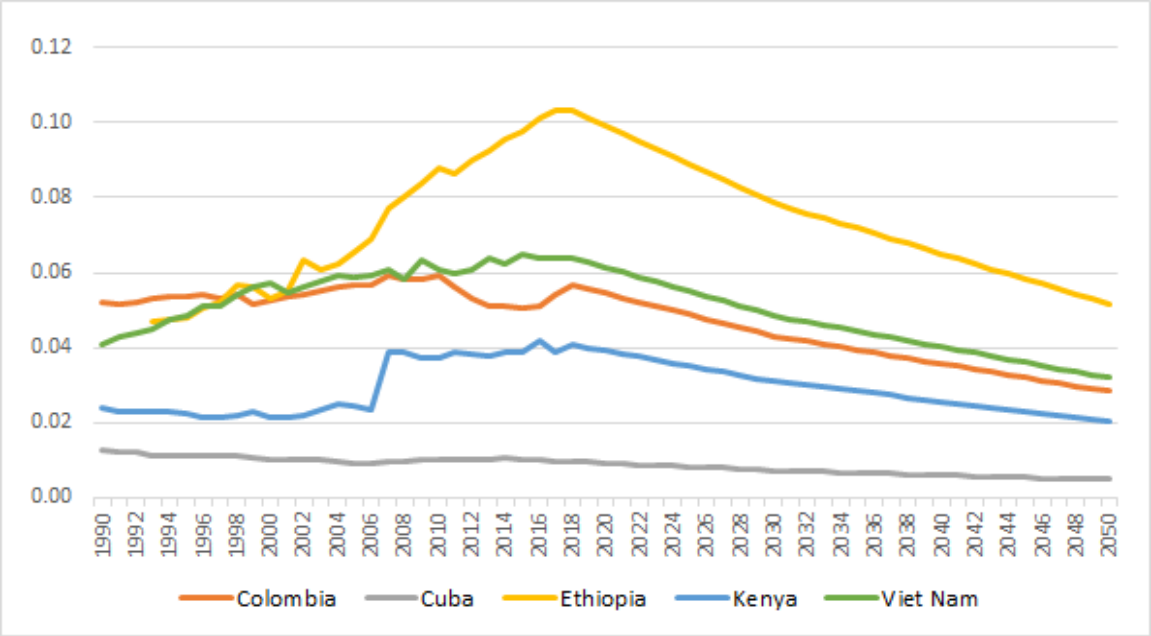


Figure 9b. Agricultural GHG emissions for selected developing countries (Colombia, Cuba,

Ethiopia, Kenya, and Vietnam). Expected reduction required by 2030 and 2050 to reach the 1.5°C climate target. Of the six focus countries, China has been removed from the graph.

3.3.2 Review of what has been reported and evidenced towards set targets

25. When looking at the SLO target numbers CCAFS set out to achieve under its LED Flagship (FP3) (presented in Table 1), there are many assumptions when it comes to putting achieved numbers against these targets: (i) reported numbers are just coming in for 2020; (ii) targets were set for 2022 and the CRPs were cut short by one year; and (iii) aggregation of numbers across the different countries where level of engagement has been staggered and the countries are at different stages.

26. Therefore, we looked at progress reported and evidenced by 2020 towards the formulated 2022 outcomes and targets (from table 2). The projects mapped reported results such as innovations, policies, and outcome impact cases towards the five outcome indicators (agricultural development initiatives, hectares targeted, LED plans developed, organizations adapting to increase women's participation in LED, and policy decisions taken). These can be seen as proxies to indicate progress and are well evidenced. The numbers are shown in the utmost right column of Table 8. This indicates that the program is delivering evidence against their targets policies, innovations, and behavioral changes. Monitoring and reporting data is less aimed at hectares targeted or organizations adapting their plans or directing investment to increase women's participation in LED decision making. The latter can be complemented through the survey responses where strengthened women scientists' contributions to MRV was mentioned among the top five changes for which survey respondents can provide evidence of CCAFS' contribution.

Table 8. CCAFS Reporting against sub-IDO targets and related evidence

2022 Outcome Descriptions	Target by 2020	Evidence Reported to CCAFS* by 2020
20 **agricultural development initiatives** where CCAFS and science is used to target and implement interventions to increase input efficiency	12	5 Innovations 2 Policies 8 Outcome Impact Case Reports (OICRs)
0.8 million **hectares targeted** by research-informed initiatives for restoring degraded land or preventing deforestation	0.5	1 Innovations 0 Policies 0 OICRs
10 **LED plans developed** that have significant mitigation potential for 2030, i.e., will contribute to at least 5% GHG emissions reduction or reach at least 10,000 farmers, with all plans examined for their gender implications	6	17 Innovations 17 Policies 17 OICRs
15 **organizations adapting** their plans or directing investment to increase women's participation in decision-making about LED in agriculture	10	0 Innovations 0 Policies 1 OICRs
15 **policy decisions taken** (in part on engagement and information dissemination by CCAFS	8	10 Innovations 6 Policies 4 OICRs

* The numbers presented are taken from MARLO (Managing Agricultural Research for Learning and Outcomes), the Management Information System used by CCAFS. Please note that Innovations, Policies and OICRs can be tagged in up to three sub-IDOs, and these numbers are not unique, e.g., 1 OICR may be tagged to both "low emissions plan developed" and "policy decisions taken". Please see Appendix 1 CCAFS Evidence to find more details on the evidence and sub-IDO tags.

27. Key informants provided quantifications for project-level progress towards impacts such as investments, beneficiaries, and emission reductions for selected countries. Some of these project-level quantifications are presented in Table 9.

Table 9. Selected countries' quantification of project-level progress towards impact*

Country	Project	Investment	Beneficiaries	Emissions Reduction
Ethiopia	Oromia Forested Landscape Program (OFLP) ETHIOPIA	US$ 18 million development grant (approx. value)	1.8 million people living in or near forest	15.46 million $mtCO_2e$ This is the forest component. Livestock component not yet known.
Ethiopia	Livestock and Fisheries Sector Development Project (LFSDP)	US$ 176 m	1.2 million households	1.7 million $mtCO_2e$
Kenya	Livelihoods Mt Elgon project	Confidential	30,000 households	1 million $mtCO_2e$
Kenya	Kenya Climate Smart Agriculture Project (KCSAP)	US$ 280 m	521,500 households	5.5% reduction target (total volume not known)
Kenya	The National Agricultural and Rural Inclusive Growth Project (NARIGP)	US$ 219 m	360,000 households with average of 5-8 members each	No target
Vietnam	Alternate Wetting and Drying technology	N/A	50,000 rice farmers	1 million $mtCO_2e$ /yr

* New or revised MRV systems barely influence the development of these projects. The impact of the MRV system on project design and implementation is limited.

4. Lessons learned

The lessons learned reflect the survey respondents' observations. The insights shared reveal a deep expert understanding and commitment. See Survey Responses for full details. Below we share a summary of the responses received.

1. Where has CCAFS research and support for MRV been most successful?

CCAFS research and support for MRV has been most successful in the areas of partnership, capacity building, innovations, and policy influence. CCAFS' ability to create strategic partnerships with national governments has fostered capacity development and supported the exchange of research findings, dissemination, and uptake of innovations. The work has influenced policy and attracted private sector funding. Some of the biggest achievements include increased capacity for MRV, Tier 2 livestock development and the CLIFF-GRADS scholarship program, which continues to be a confirmed success by its scholarship fellows. This was stated in the high response rate of CLIFF-GRADS students and their enthusiasm to share their observations of change towards impact.

The top three output clusters that respondents were most aware of and that provide evidence of CCAFS' contribution to change and impact are:

- general resources (85%/32%),
- capacity building (84%/23%) and
- Tier 2 MRV livestock (75%/18%).

The top five observed changes reported were: improved activity data (67%), improved emission factors (47%), improved mitigation planning (39%), shift to Tier 2 MRV for livestock (31%), and women scientists' contributions to MRV (31%).

2. How can CCAFS' research and support for MRV be improved?

Many of the respondents confirmed continuation of the current activities: partnerships, capacity building and building awareness. The suggested improvements, which can be pointers for future consideration, were focused on the following areas:

- **Partnerships**. In addition to current partnerships, there was also the request to work with the media to disseminate data to [food] consumers.
- **Standards and strategies**. Invest more in mainstreaming interventions, e.g., standardized baselines, strategies for scaling up, developing a standardized collection form, and incorporating incentive mechanisms.
- **Importance of aligning to national processes.** Project implementation should be aligned to the country's NDC to properly count emissions reduction; the potential role of GHG inventories and sustainable development impacts should be consistent with national processes.
- **Project design.** Start the project with a consensus on the problem, desired research and development aims; ensure continuous funding for research; include MRV in the [project] log frame, with continuous monitoring and evaluation for feedback; strengthen livestock sector MRV systems and integrate them with AFOLU MRV systems.

3. What are the priorities for future work on MRV in agriculture and food systems?

The survey respondents provided a wide variety of replies; however, capacity building on Tier 2 Livestock was the biggest priority, including updating the MRV system to Tier 2. Food systems' transformation ranked second, with a focus on reducing food waste for mitigation. The role of pastoral land use and the potential role of GHG inventories was also mentioned, "the revitalization of traditional practices and indigenous knowledge is vital to secure sustainable livelihoods for millions of pastoralists, to maintain pastoral land use and to mitigate and adapt climate change impact." One survey respondent would prioritize the connection between mitigation projects and the carbon market.

5. Conclusions

The qualitative and quantitative results of this evaluation, based on the CCAFS program's reporting and documentation of evidence, strongly support that CCAFS' work on MRV over the past ten years has successfully put in place the right mechanisms and incentives to support the achievement of FP3 goals and higher-level global climate-related targets. It has developed a series of tools, approaches, networks for exchange and sharing across countries, and capacity in key positions, champions in governments, research, and South-South collaborations to support and enable the continuous improvement of MRV criteria that are critical to achieving the CCAFS Program and CGIAR system-level set targets, and ultimately the SDGs and commitments of the Paris Agreement.

This conclusion is supported by the evaluation findings, summarized below according to our six evaluation questions.

1. **What were the outcomes and impacts or impact indications of CCAFS' research work on MRV? What was reported with regard to GHG emission reductions, hectares covered, and farmers implementing the improved technologies? What was reported in terms of changes in policies and capacity developed, and specific innovations?**

Survey results indicate that CCAFS has created a high awareness around their resources, notably the general resources, on capacity building and Tier 2 MRV in livestock. Those were also the areas for which the respondents were most able to provide evidence of impacts, including improved activity data (64%), improved emission factors (47%) and improved mitigation planning (39%). Mitigation impacts were reported by two-thirds of the respondents. Countries reporting the benefit of impacts were China, Ethiopia, France, Indonesia, Kenya, Uruguay, Vietnam, and Zimbabwe.

Approximately one-third of all respondents were able to estimate improvements in GHG emissions mitigation, benefits to farmers, and the number of hectares where improvements were occurring. Further in-depth analysis would be necessary to accurately present and calculate these impact-level benefits on the number of people, hectares, and reduction of agriculturally-related GHG emissions.

The 12 interviews as follow ups from the survey responses focused on the country-specific MRV work. From these interviews, another three key informants with country-specific expertise were identified. From the total of these 15 interviews, the outcomes reported by country are summarized below and the detailed cases are documented in Annex VII. Specific Outcomes**.**

- In **Brazil,** CCAFS' support and resources helped EMBRAPA enhance MRV capacity for livestock and shape a livestock initiative. Knowledge sharing and use of CCAFS knowledge products contributed to the launch of a "carbon-free meat" labeling initiative linked to livestock and emission reductions in the private sector.
- In **China**, the Ministry of Ecology and Environment partnered with CCAFS to develop provincial guidance for MRV in the livestock sector using Tier 2 methods. The guidelines were rolled out over seven training events with 1300 participants to build capacity among the provinces. The new MRV guidelines for the livestock sector support the implementation of China's NDC in the agricultural sector.
- In **Colombia**, CCAFS-CIAT has made key contributions to support Tier 2 reporting, resulting in an improved national GHG emissions inventory. A calibrated RUMINANT model helps to analyze the quality of feed and provide emission estimates in a cost-effective way.
- **Ethiopia** validated and adopted a Tier 2 GHG emissions inventory for livestock with support from CCAFS and UNIQUE, based on multiple outputs.
- **Kenya** adopted Tier 2 methods for dairy cattle with CCAFS support. The Cattle Methane Similarities Matrix Calculator was used to validate estimated emissions.
- In **Vietnam,** CCAFS-IRRI and the Ministry of Agriculture and Rural Development contributed to evaluating mitigation options in paddy rice cultivation, which

supported improvements in their national GHG emissions inventory, NAMA and 2020 updated NDC (No. 14).

From 2017 to 2020, **22 innovations, 20 policies and 22 outcome impact cases** have been reported from the projects to the CCAFS program, presented as evidence of progress towards defined outcome indicators for FP3. These impacts map and align with the indicators used for the climate-change goals of the SDGs Global Indicator Framework 13.2. ,13.3 and 13.b (UN IAEG-SDGs, 2020). This way CCAFS can provide causality that its work contributes to the SDGs. Links to how the indicators below are being tracked by countries are provided in the footnote.

- 13.2.1 Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change
- 13.3.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment; and
- 13.b.1 Number of least developed countries and small island developing States with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change

2. Why have these results occurred? Has the program influenced the observed results? and has the program made an (important) contribution to the observed changes and results?

More than 500 people have been engaged and involved in the workshops, knowledge sharing and capacity building events. Additionally, all resources were made publicly available. For the listed resources provided to survey respondents, see Annex II. List of MRV Resources which includes numbers of downloads, page views, total users and Altmetrics

from respective analytics. From these statics, the top seven most either downloaded, viewed or accessed resources created by CCAFS with its partners are:

- Standard Assessment of Agricultural Mitigation Potential and Livelihoods - SAMPLES website, SAMPLES publications, SAMPLES methods (almost 57K pageviews between Jun. 2015 – Dec. 2017, data collection was interrupted between 2018-2020)
- MRV Platform for Agriculture website (since Dec. 2018 – May 2021) with almost 40K views since its existence Dec. 2018 - till May 2021 and over 13K users.
- CLIFF or CLIFF-GRADS PhD research fellowship programs (over 6K pageviews since its existence 2011 - May 2021)
- Environmental Research Letters Special issue "Focus on Improving Quantification of Agricultural Greenhouse Gases," with Duke University. (almost 5K downloads since it went online 2013 – May 2021)
- Report: Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement (almost 5K downloads since it went online 2017 - May 2021) Report: Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement (4,638 downloads since it went online 2017)
- Webinar: Soil carbon MRV and finance (about 1,000 views)
- Webinar: Soil carbon MRV and finance (968 views)
- Counting tree contribution (Publication: Yeeles, Counting tree contributions. A. *Nat. Clim. Chang.* 9, 577 (2019). (Almost 600 accesses since it came out 2019 - May 2021)

The survey results and interviews confirm that CCAFS work contributed to the evidence of MRV outcomes. The observed results can be attributed to the CCAFS work on MRV and the successful delivery model for partnering and bringing people together to exchange and learn.

3. What roles did the CCAFS' MRV work play? And is it reasonable to conclude that the program has made a difference?

As per the survey results, there is a link between "awareness" of MRV resources and the ability to provide evidence of impact and change. The strengths of the program are the ability to make these resources available through strategic partnerships and capacity building and to further disseminate that information through extensive training programs. The role in Tier 2 MRV for the livestock sector was also substantial.

As a counterfactual, according to the opinion of survey respondents and the key informants, had CCAFS not developed the MRV resources and organized the events to share and build capacity, these results and changes would not have occurred. CCAFS fills a niche and it has reacted with its clusters of MRV to clearly defined and voiced demands from country partners and manifested in the signing of the Paris Agreement.

4. What does the preponderance of evidence say about how well the program is making a difference?

The evidence confirms that the program is making a difference. Based on CCAFS' FP3 outcome stories, some countries have an abundance of evidence. The role of CCAFS is clear in countries where there has been more time to measure the impact (e.g., Colombia, Ethiopia, Kenya, and Vietnam). There are, however, many other societal actors involved that have contributed to or catalyzed the process.

In other countries where CCAFS' MRV is more recently emerging, there is less evidence of impact. However, in these countries (e.g., Brazil, Cuba, and Nigeria), we can see that a CCAFS agent of change is working within these countries to make progress. The body of evidence in these cases will need to be reviewed in the future to see if they hold up and confirm the pattern or not.

The different types of spillover examples, collaboration, dissemination, and transferal provided by key informants where the MRV work of CCAFS implementing partners spilled over into other countries is a good sign that the program is also making a positive difference by attracting other countries to build upon, adjust, and adopt CCAFS outputs and outcomes. It is expected that more of these ripple or spillover effects will occur in the coming years as the use of CCAFS materials becomes more evident.

5. What conditions are needed to make this type of program succeed?

The **delivery model** with strategic partnerships, including government champions, research expertise, and South-South countries' knowledge exchange was deemed **successful in the selected countries** where we received confirmation from partners and government-affiliated key informants. Some partners commented that the successful delivery model also included the private sector as a fourth player in the delivery of outcomes. This was mentioned in particular for the work in Ethiopia, Kenya, and Vietnam. Other examples that worked for the countries include:

- Close collaboration with international partners (e.g., GRA, FAO)– (Kenya and Ethiopia)
- Dissemination partners (e.g., CAC) shared Cuba's experience with rest of Latin America)
- Establishing long-term partners to build trust, which facilitated the dissemination of outputs, and also regarded CCAFS-CIAT as an expert when advice was needed (Colombia)
- Supporting travel for partners to attend key international meetings, which exposed the scientists to new ideas and catalyzed interest (Brazil)
- The pathway to change has been through the development of scientific evidence, the dissemination of evidence through guidelines and tools, and targeted capacity building to ensure uptake and mainstreaming (Vietnam)
- Other factors applicable to all countries include political diplomacy, skillful selection of strategic partnering, good leadership, and quality of research

6. What quantifications can be made with the findings from the above questions, if contribution of the program can be verified?

The difficulty of finding rigorous evidence for the level of GHG emissions reductions associated with MRV improvements to quantify progress towards the high-level SLOs were also mentioned by the CGIAR MEL COP in a recent statement to the CGIAR System Management Office. This mention lists a wide range of evaluative work that can be brought forward to show progress and achievements towards the SLOs. Their target point No. 5, says "We can use the above body of evidence to tell a story of contribution to the aspirational targets in the CGIAR Strategy and Results Framework 2016-2030 and CRP Phase II (2016). However, given the rigor of evidence required, we are unable to quantify and aggregate these contributions across the diverse CRP and Platform portfolio."

Aggregation of numbers towards the high-level targets, proves to be similarly difficult to the CRP work within and across the project portfolio, and for example, the MRV body of work. However, some country-level quantification with disclaimers and specifications can be considered when analyzing the countries' figures and the compiled outcome cases (e.g., for Ethiopia, Kenya, and Vietnam in Section III Results, 3. point 26. and Annex VII.)

Annex I. Terms of Reference for the Evaluation

Introduction

CCAFS seeks to address the increasing challenge of global warming through strategic, broad-based global partnerships, as it recognizes that no single research institution working alone can address the critically important issues of global climate change, agriculture and food security. Led by the International Center for Tropical Agriculture (CIAT), CCAFS is a collaborative effort among all 15 CGIAR Research Centers and coordinates matters of thematic relevance with the other CGIAR research programs. All CGIAR Centers have a stake in CCAFS, and numerous Centers hold considerable climate change expertise and activities. CCAFS brings together some of the world's best researchers in agricultural science, climate science, environmental and social sciences to identify and address the most important interactions, synergies, and trade-offs between climate change and agriculture.

CCAFS aims to define and implement a uniquely innovative and transformative research program that addresses agriculture in the context of climate variability, climate change, and uncertainty about future climate conditions. The program is carried out with funding support from governments and aid agencies, both through the CGIAR Trust Fund and bilateral research agreements. The program is structured into four large programmatic work areas called Flagships (FP): (FP1) Priorities and policies for Climate Smart Agriculture; (FP2) Climate Smart Technologies and Practices; (FP3) Low Emissions Development and (FP4) Climate Services and Safety Nets.

This sensitive investment of resources and approaches by CCAFS to achieve maximum value requires continuous reflection and evaluation, especially as we approach the last year of the phase 2 of the program. By helping to better understand the complex mechanisms that lead

to long-term impacts at scale, the purpose of the Flagship evaluations is to facilitate learning and demonstrate how CCAFS activities can add value in catalyzing global change.

This evaluation focuses on selected key parts of the work conducted under FP3. Since 2010, CCAFS has collaborated with a wide range of partners on FP3 on Low Emissions Development with the **overall objective of conducting research to increase the capacities of national and project implementation agencies for MRV emissions and mitigating action of low-emission livestock development programs, including the national inventories.** From this work a wealth of information and method resources were created.

The **assumptions underpinning FP3** are that (i) achieving this objective will help developing countries achieve their nationally determined contributions (NDCs) and meet their obligations under the Paris Agreement (Article 13); (ii) increased access to finance for low-emissions livestock development (including C projects) will be generated; and (iii) low-emission livestock investments will be mainstreamed in the investment operations of financial institutions (e.g., World Bank).

Purpose of the evaluation

Having made a significant research investment into its mitigation work (USD XX$$ over 10 years), CCAFS conducted this evaluation to better understand if and how its MRV work, research outputs and activities, combined with a set of political inputs, have produced policy outcomes (e.g., what has changed, how, and for whom) and if they have led to GHG emissions reduction.

The primary objectives of the evaluation are the following:

7. Determine and document how and in what ways evidence from CCAFS research and engagement activities on MRV contributed to the achievement of intended/unintended outcomes (see the section Proposed Evaluation Approach and Methods that follows).

8. Based on findings of the evaluation, elaborate what has changed, e.g., GHG emissions and number of beneficiaries, and hectares as a result of the CCAFS MRV work, for whom and why, including any measurable benefits.
9. Calculate the benefits at set time intervals (e.g., 2022 and 2030).
10. Serve as a participatory learning experience for CCAFS and partners.

Scope

CGIAR has adopted an ambitious SRF that aims to help achieve a set of global goals, including the SDGs by 2030. In phase 2 of its funding (2017-2022), CCAFS was designed to contribute directly to several SLOs promoted in the SRF. The relevant SLOs and CCAFS target contributions —and specifically defined for Flagship 3—are shown in the table below:

Indicator on the CGIAR system level (SLO target No.)	**CGIAR target by 2022**	**CGIAR target by 2030**	**CCAFS FP3 target by 2022**	**SDG reference**
Increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse (7)	5%	20%	20 initiatives in 5-8 countries	6.4.1 6.3.1
Reduction of agriculturally related GHG emissions compared with business as usual scenario in 2022 (8)	0.2 Gt CO_2-e yr^{-1} (5%)	0.8 Gt CO_2-e yr–1 (15%)	0.16 Gt CO_2-e yr–1 (4%)	13.2.1 13.3.1 13.3.2
Hectares (ha) degraded land area restored (9)	55 m	190 m	0.8 m (1.45% of CGIAR target).	15.3.1
Hectares (ha) of forest saved from deforestation (10)	2.5 m	7.5 m	0.8 m (32% of CGIAR target)	15.1.1

There are a few challenges identified to be addressed through this evaluation:

1. Translation of CCAFS work to the SDGs and CGIAR System Level Outcome Targets.
2. CCAFS can only claim it makes contributions through the highly collaborative nature of its work in strong partnerships. Attributional claims can only be made for the partnership.

3. Capturing impacts at multiple unit levels and scale of impact: national and subnational, project impacts, emissions/ha v emissions/kg is necessary.

Primary geographic focus of the FP3 interventions/of the evaluation: China, Columbia, Ethiopia, and Kenya; potential secondary areas: Brazil and Vietnam.

Key evaluation questions

The evaluation should aim to answer the following key questions:

1. Why has the result occurred? Has the (CCAFS) program influenced the observed result? and has the program made an important contribution to the observed changes and result?
2. What roles did the CCAFS MRV work play? Is it reasonable to conclude that the program has made a difference?
3. What does the preponderance of evidence say about how well the program is making a difference?
4. What conditions are needed to make this type of program succeed?
5. What quantifications can be made with the findings from the above questions, specifically with regard to question (3), if the program's contribution can be verified.

Proposed outputs

The evaluation / assessment is expected to produce the following outputs:

1. Evaluation design through scoping meeting(s) with CCAFS staff and partners to identify/confirm key evaluation questions and potential outcomes of interest, and to discuss proposed evaluation methodology.
2. Close collaboration and periodic check-in meetings with CCAFS contact point to ensure that the methodology and/or its adaptation works towards the evaluation purpose. This includes the sharing and refinement of the survey before sending it out, interview

questions for key informants and follow-up on required evidence documents. Draft final reporting structure for discussions. As we value quality and conciseness, the target length of the report will be agreed before writing the draft report and will be reviewed during one of the periodic check in meetings.

3. Based on the draft report submitted, participate in an exercise with CCAFS team to comment, discuss and make sense of the evaluative findings.
4. Produce a finalized evaluation report that answers the evaluation questions to sufficient level of quality and detail as to be useful to CCAFS as a stand-alone five-page executive summary of the evaluation.
5. Working with the CCAFS Communications Unit, prepare a short blog to showcase the evaluation process and its key findings.

Proposed Evaluation Methods and Approach

We agreed to combine qualitative evaluation approaches with a quantitative analysis in our assessment of FP3 impact. Both methods were strongly based on a theory of change approach. We adapted steps of the Contribution Analysis and Outcome Harvesting to develop narrative outcome descriptions of CCAFS' contributions to changes. To respond to the strong need for quantifications, and especially towards selected CGIAR target indicators of the Strategy and Results Framework 2016-2030, we complemented these approaches with economic analysis to calculate GHG emission reductions, people's wellbeing and hectares affected.

The following six steps outlined below were proposed to produce a credible contribution story:

Step 1: Evaluation design—Set out the attribution problem to be addressed

Step 2: Develop a theory of change and its risk

Step3: Gather the existing evidence on the theory of change—engage with informants to harvest and verify outcomes

Step 4: Substantiate and interviews—Assemble and assess the contribution story, or performance story, and its challenges

Step 5: Seek out additional evidence—data analysis, interpretation and synthesis

Step 6: Support use of findings—for future revision and, where additional evidence permits, to strengthen the contribution story

Timeframe: Initially 2020, extended to Q1 in 2021

Budget: USD 15K

Annex II. List of MRV Resources

Cluster	Type and Examples
Cluster 1	**General resources on MRV and GHG measurement**
	• MRV Platform for Agriculture website • Standard Assessment of Agricultural Mitigation Potential and Livelihoods - SAMPLES website, SAMPLES publications, SAMPLES methods
Cluster 2	**Tier 2 MRV in livestock**
	Workshops and publications related to improving Tier 2 MRV of livestock • Report: Livestock activity data guidance • Report: Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement • Brochure: Livestock development and climate change: the benefits of advanced greenhouse gas inventories • Resource portal: Tier 2 inventory approaches in the livestock sector: A collection of agricultural greenhouse gas inventory practices • Expert workshop with the GRA, 17-18 Jul. 2018 the Hague, Improving activity data for Tier 2 estimates of Livestock Emissions: Dealing with Data Gaps • Expert workshop with GRA and FAO, 20-21 Feb. 2017 Rome, Making MRV Work. Workshop on implementing MRV to meet countries' mitigation and sustainable development goals in the livestock sector
Cluster 3	**Country-focused MRV**
	• Colombia on the RUMINANT model • Potential mitigation contribution from agroforestry to Vietnam's Nationally Determined Contribution • Vietnam's livestock feed database and tool (USDA EC-LEDS) • Kenya on livestock emissions by the GRA and UNIQUE • Ethiopia MRV development for livestock emissions, facilitated by UNIQUE • China: Carbon Footprint Assessment and Mitigation Options of Dairy under Chinese Conditions and Tier 2 MRV of livestock emissions in China: Developing Guidance for Implementation at the Provincial Level
Cluster 4	**East Africa MRV for livestock and dairy**
	• Gold Standard smallholder dairy methodology • Article: Central Kenya smallholder dairy GHG baseline survey and the methods working paper • Article: Pasture urine and dung emissions • Too : Cattle activity data similarities calculator • Article: Improved emission factors for enteric fermentation
Cluster 5	**MRV for smallholder farmers**
	• Smallholder emissions workshops with FAO-MICCA • reducing the costs of GHG estimates in agriculture to inform low emissions development (#1), CCAFS-FAO, 10-12 Nov, 2014 Rome.

	• Quantifying Agricultural Greenhouse Gases in Developing Countries (#3), CCAFS-FAO-MICCA- Duke University. Apr. 2012 • Smallholder Mitigation: Whole Farm and Landscape Accounting (#4), CCAFS-FAO-MICCA expert workshop, 27-28 Oct 2011, Rome • Towards a Framework for Smallholder Agricultural Mitigation (#6), CCAFS-FAO-MICCA 13 July, 2010 • Environmental Research Letters Special issue "Focus on Improving Quantification of Agricultural Greenhouse Gases," with Duke University
Cluster 6	**MRV and paddy rice**
	• SECTOR, GHG calculator for paddy rice emissions, see also article on methodology (2019) • Handbook of Monitoring, Reporting, and Verification for a Greenhouse Gas Mitigation Project with Water Management in Irrigated Rice Paddies (2018) • Guidelines for Measuring CH4 and N2O Emissions from Rice Paddies by a Manually Operated Closed Chamber Method, Version. 1 (2015)
Cluster 7	**Other land use**
	• MRV of agroforestry • Making trees count: Measurement and reporting of agroforestry in UNFCCC national communications of non-Annex I countries • Counting tree contribution
Cluster 8	**MRV for the finance sector**
	• Green bond certification criteria: Climate Bonds Initiative Agriculture Criteria • Webinar: Soil carbon MRV and finance
Cluster 9	**Capacity building**
	• CLIFF or CLIFF-GRADS PhD research fellowship programs

Annex III. Survey questions

The required questions are flagged with an asterisk (*).

Part A - General

Q1. Do you work for an organization that …. [please tick if applicable - multi selection possible] *

- is responsible for MRV of agricultural GHGs?
- contributes to improving MRV of agricultural GHG emissions?
- can take action to reduce agricultural GHG emissions by supporting e.g., a policy, a program, or action on farms?

Q2. What type of organization do you work for? Please select. [single option only] *

- Academic & Research
- Government
- Ministry of Agriculture
- Ministry of Environment
- Intergovernmental body
- Civil society/non-governmental
- Development Organizations
- Private Sector/ business
- Foundation and financial institutions
- Community-based organizations
- Farm
- Other: _____

Q3. What is your role? Check all that apply: [multi-selection possible] *

- Research
- Knowledge-related role
- Administration
- Management
- UNFCCC negotiation

- Finance
- Policy advisory/decisions
- Program/ project implementation
- Farming
- Monitoring and evaluation
- Other: _____

Q4. Do you know of the CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS)? *

- Yes
- No

Part B - Relationship to CCAFS, use of products and events

Q5. CCAFS with its partners has produced a wider range of products over the past 10 years. These can be roughly clustered as below. You can find a list of example products in the e-mail invitation to this survey or under this link *

Please indicate what applies for each cluster of CCAFS related products. [multiple choice possible]

1 = I am not aware of any of the resources listed under this cluster.

2 = I have read at least one document or participated in at least one event.

3 = I have contributed to the work and/or was part of the team who developed the product.

4 = I have used a resource, but do not have evidence of impact/change.

5 = I have used one or more of these resources and can provide some evidence of impact/change.

- Cluster 1 - General resources on MRV and GHG measurement
- Cluster 2 - Tier 2 MRV in livestock
- Cluster 3 - Country-focused MRV
- Cluster 4 - East Africa MRV for livestock and dairy

- Cluster 5 - MRV for smallholder farmers
- Cluster 6 - MRV and paddy rice
- Cluster 7 - Other land use
- Cluster 8 - MRV for the finance sector
- Cluster 9 - Capacity building

Q6. Have you observed any of the changes listed below as a result of CCAFS outputs and events listed above? Check all that apply. *

- Improved activity data
- Improved emissions factors
- Improved typology of producers
- Shift to Tier 2 estimates
- Improved mitigation planning, options or targets
- Improved baselines Setting mitigation targets
- National or subnational MRV system
- Increase in women scientists' contribution to MRV
- None
- Other: _____

Q6.1 Please specify in which countries/ projects (list all)

Q7. Please indicate to what level did CCAFS outputs or events contribute to some key types of changes - refer to the list of examples of resources (under questions 5 - and provided as an attachment in the e-mail out to you), if useful. CCAFS outputs or events contributed to the change of ... *

- New knowledge
- New capacity or skills
- New networks or access to new colleagues
- Access to new resources
- Opportunity to test novel practices

Levels: (1) Very low or no change - (2) Low - (3) Medium - (4) High - (5) Very high

Part C – GHG mitigation impacts

Q8. Has MRV informed any GHG mitigation in agriculture in your project/ country? *

- Yes
- No

Q8.1. If yes, in which projects/countries (list all)

Q8.2 If yes, please try and estimate the level of GHG mitigation in the agriculture sector potentially informed by improved MRV to date? Consider absolute emissions (not emission intensity) reductions and/ or carbon sequestration and emissions reductions. Estimated reductions check as applicable:

- More than 10 million tons of CO2e
- 1-10 million tons of CO2e
- 100,000-1 million tons of CO2e
- None yet
- Do not know
- Does not apply

Q8.3 If yes, please share your estimated number of benefiting farmers.

- Up to 100,000
- 100,000-1 million
- 1-10 million
- More than 10 million
- None yet
- Do not know
- Does not apply

Q8.4 If yes, please share your estimated size of area.

- Up to 100,000 hectares
- 100,000-1 million hectares
- 1-10 million hectares
- More than 10 million hectares

- None yet
- Do not know
- Does not apply

Q8.5. Please select/check all the sectors involved in the reduction given above.

- livestock
- paddy rice
- N-fertilizer or nutrient management
- agroforestry
- deforestation
- Other: _____

Q8.6. Please indicate any potential evidence/ documents to back up any given figures above

- Policy/program/project documents
- Published reports, briefs, info-notes

Part D - Learning and looking ahead

Q9.1 How could CCAFS research and support for MRV be improved? [open text]

Q9.2 Where has CCAFS research and support for MRV been most successful? [open text]

Q9.3 What are priorities for future work on MRV in agriculture and food systems? [open text]

Annex IV. Survey results (detailed)

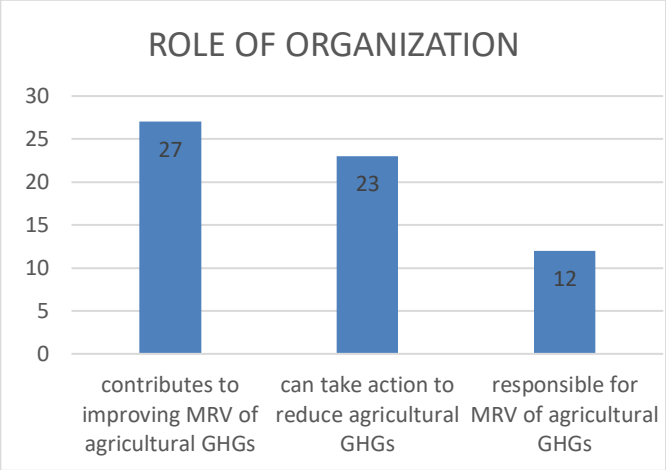
Link to Google Survey: [Assessing impact of measuring, reporting and verification (MRV) in agriculture]

The survey was sent out on 19 October 2020—during the COVID-19 pandemic—to 450 email recipients whose addresses were provided to the evaluation team; about 70 emails bounced back. From the 380 emails that were delivered, we received 32 responses. One month later, personalized, targeted emails were sent out to the contacts working in government positions. The overall response rate to the survey was less than 10% (a total of 36 responses). Of the 36 respondents, 64% had a current or past role with FP3:

- CCAFS Scientist or Key Partner (6)
- CLIFF GRAD students (17)
- Semi-internal/external Partner (13)

Part A - General

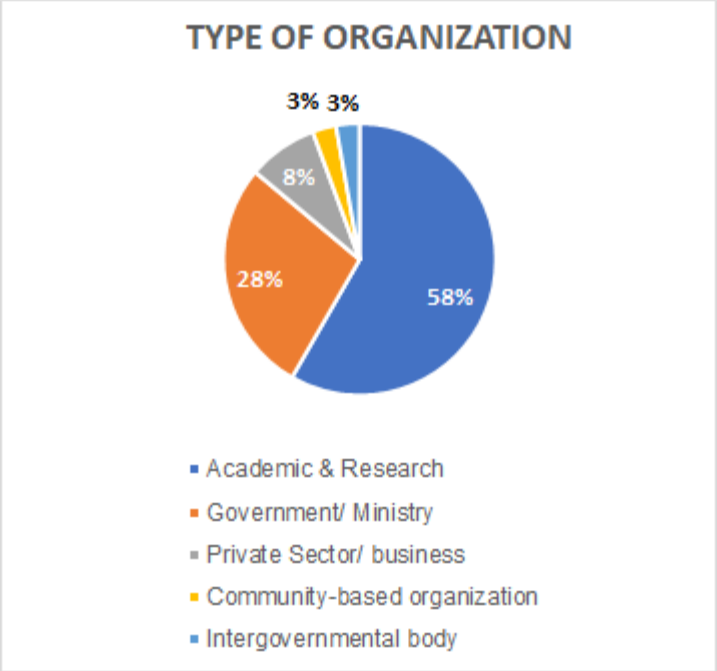
Q1. Role of the Organization - Do you work for an organization that …. [please tick if applicable – multiple selection possible]* 36 replies



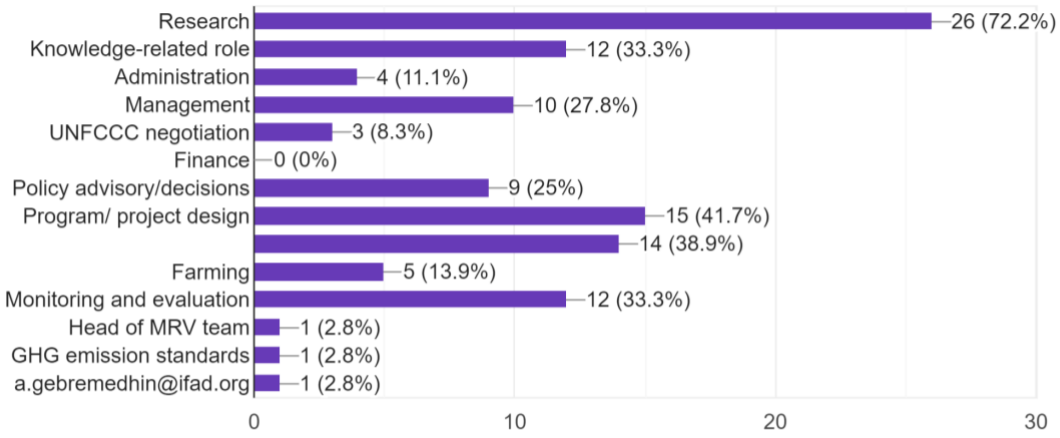
- Organization contributes to improving MRV of agricultural GHGs (N=27; 75%)
- Organization can take action to reduce agricultural GHGs (N= 23; 64%)
- Organization responsible for MRV of agricultural GHGs (N= 12; 33%)

Q2. What type of organization do you work for? Please select. [single option only] *

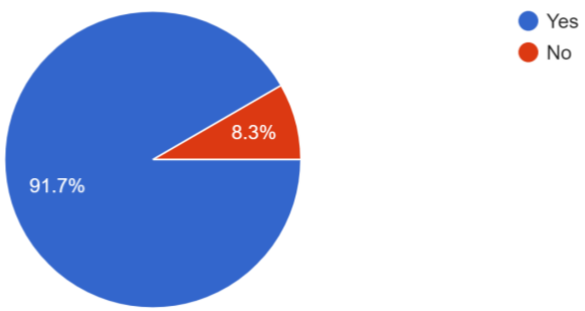
- Academic & Research (N=21; 58.3%)
- Government/Ministry (N=10; 27.8%)
- Intergovernmental body (N=1; 2.8%)
- Private Sector/ business (N=3;8.3%)
- Community-based organizations (N=1;2.8%)



Q3. What is your role? Check all that apply: [multi-selection possible] *



Q4. Do you know of the CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS)?

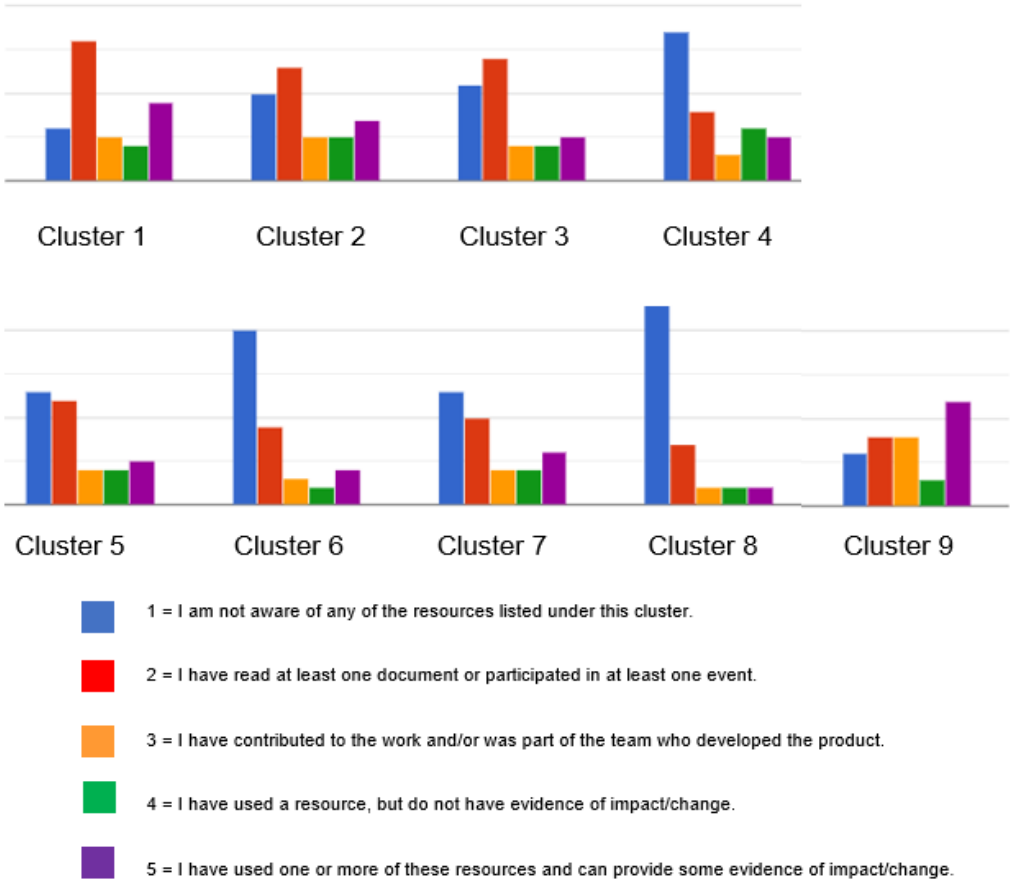


Part B - Relationship to CCAFS, use of products and events

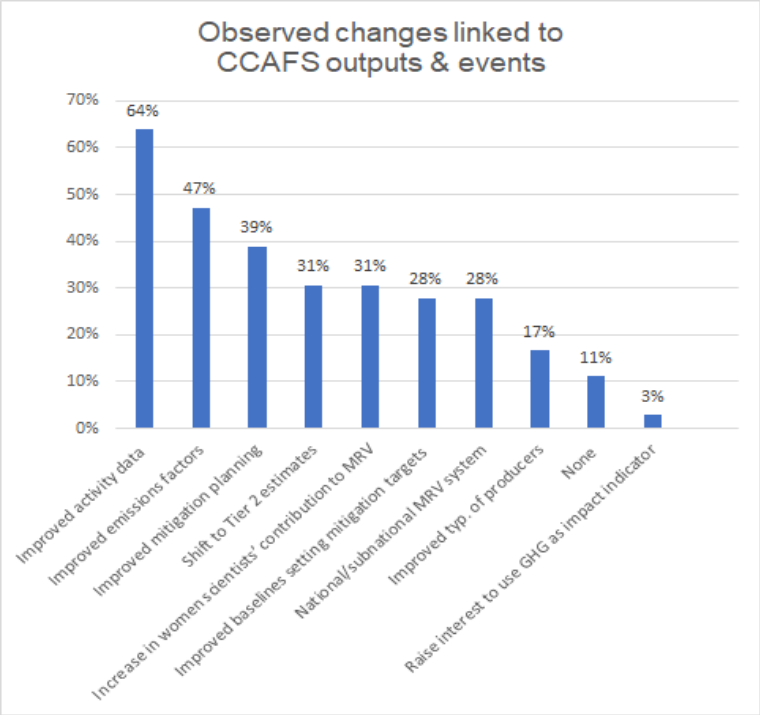
Q5. CCAFS with its partners has produced a wider range of products over the past 10 years.

Please indicate what applies for each cluster of CCAFS related products. [multiple choice possible]

- Cluster 1 - General resources on MRV and GHG measurement
- Cluster 2 - Tier 2 MRV in livestock
- Cluster 3 - Country-focused MRV
- Cluster 4 - East Africa MRV for livestock and dairy
- Cluster 5 - MRV for smallholder farmers
- Cluster 6 - MRV and paddy rice
- Cluster 7 - Other land use
- Cluster 8 - MRV for the finance sector
- Cluster 9 - Capacity building



Q6. Have you observed any of the changes listed below as a result of CCAFS outputs and events listed above? Check all that apply. *

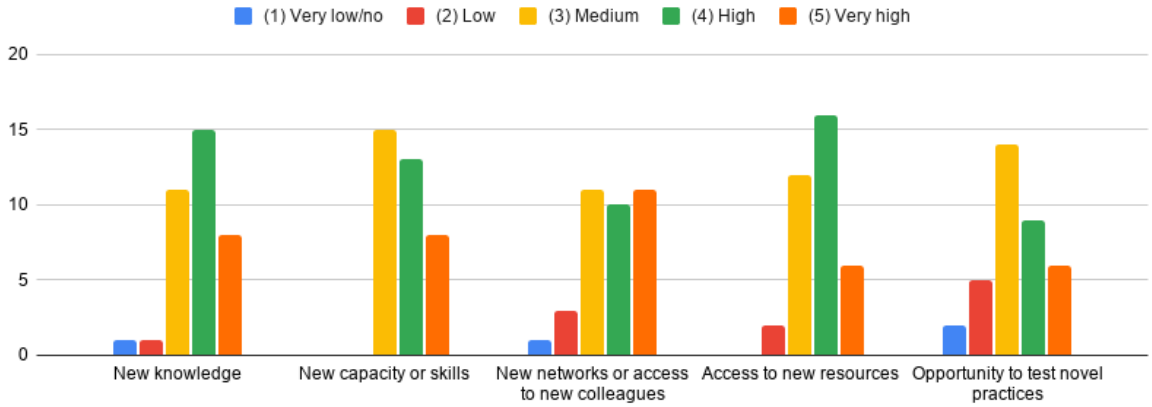


Q6.1 Please specify in which countries/ projects (list all)

Of the 36 respondents, 22 indicated they worked in specific country/ies:

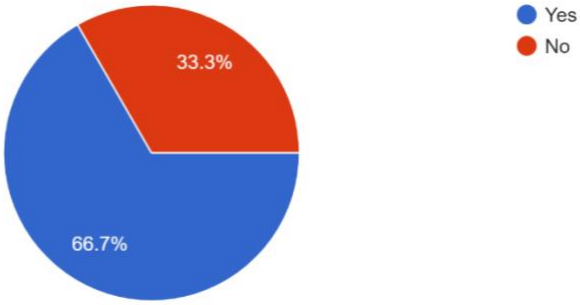
Country	Total Mentions	% Total Mention
Ethiopia	11	32.35%
Kenya	8	23.53%
Nigeria	3	8.82%
Vietnam	3	8.82%
Indonesia	2	5.88%
Argentina	1	2.94%
Bangladesh	1	2.94%
China	1	2.94%
France	1	2.94%
India	1	2.94%
Uruguay	1	2.94%
Zimbabwe	1	2.94%
Total	**34**	

Q7. Please indicate to what level CCAFS outputs or events contributed to some key types of changes:



Part C - GHG mitigation impacts

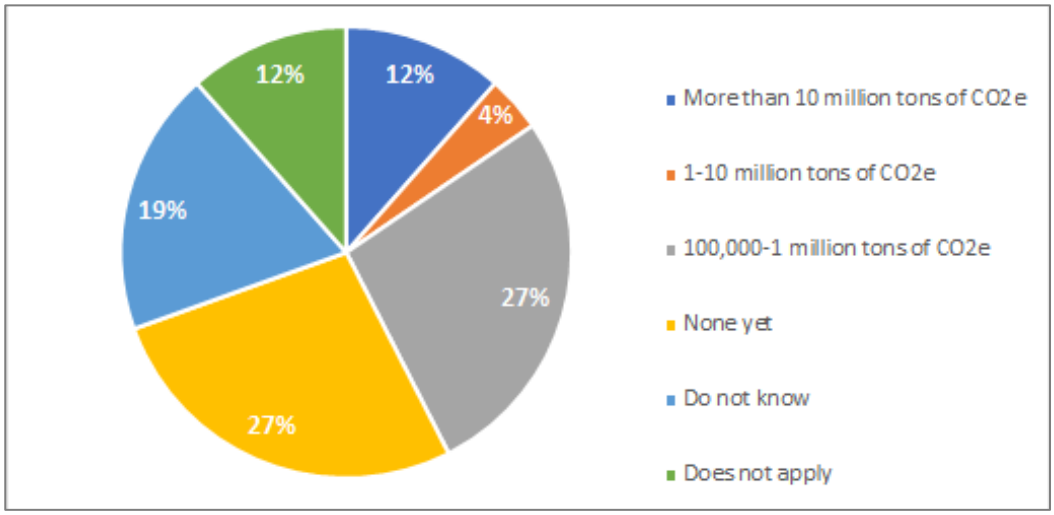
Q8. Has MRV informed any GHG mitigation in agriculture in your project/ country?



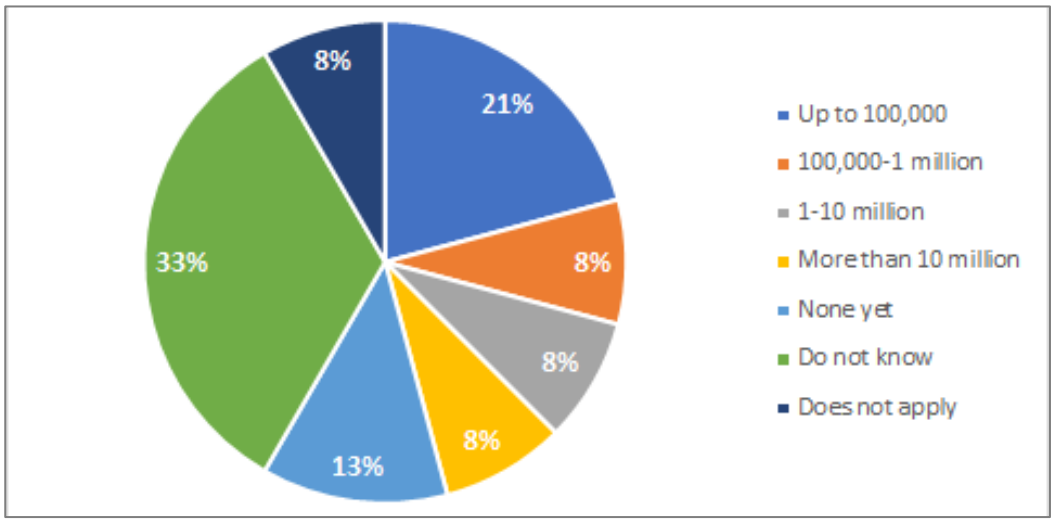
Q8.1. If yes, in which projects/countries:

Country	Total Mentions	%Total Mention
Ethiopia	9	36.00%
Kenya	7	28.00%
Vietnam	3	12.00%
Indonesia	2	8.00%
China	1	4.00%
France	1	4.00%
Uruguay	1	4.00%
Zimbabwe	1	4.00%
Total	**25**	

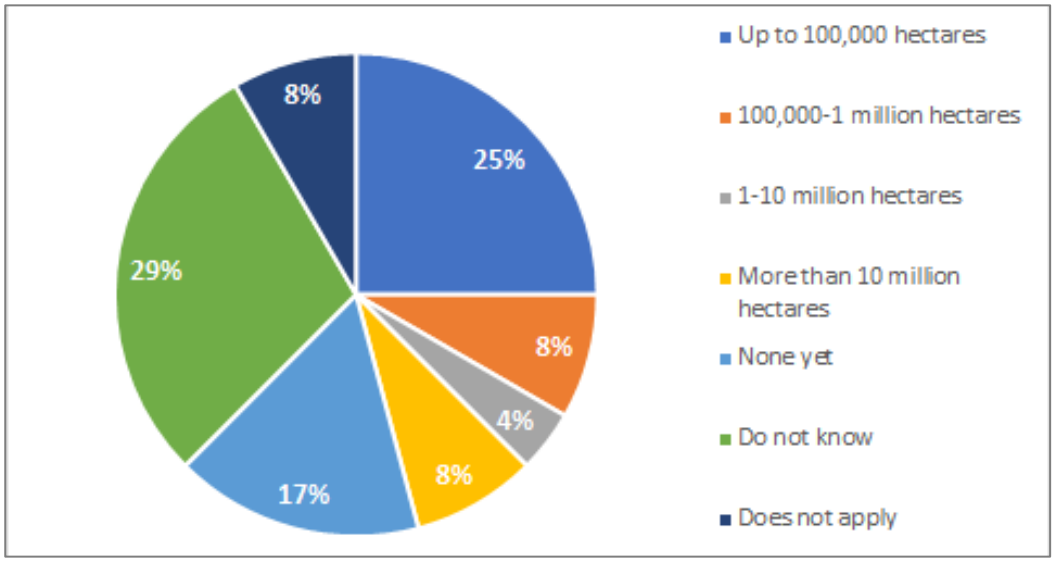
Q8.2 If yes, please try and estimate the level of GHG mitigation in the agriculture sector potentially informed by improved MRV to date? (26 replies)



Q8.3 If yes, please share your estimated number of benefiting farmers. (24 replies)



Q8.4 If yes, please share your estimated size of area. (24 replies)



Q8.5. Please select/check all the sectors involved in the reduction given above.

Sector	**# Mentions**	**%**
livestock	23	33%
agroforestry	15	21%
N-fertilizer or nutrient management	13	19%
deforestation	11	16%
paddy rice	7	10%
renewable energy initiatives	1	1%
Total	**70**	

Q8.6. Please indicate any potential evidence/ documents to back up any given figures above

	# Mentions	**%**
Policy/program/project documents	16	26%
Published reports, briefs, info-notes	14	23%
Activity data and improved national GHG	13	21%
Update of MRV systems	10	16%
Use of improved MRV system for NAMAs	8	13%
Ethiopia Tier 2 GHG inventory (in press	1	2%
Total	**62**	

Part D - Learning and looking ahead *

Comments are taken verbatim from the respondents.

Q9.1 How could CCAFS research and support for MRV be improved?

Partners

- Continuing to work with partners to provide support and guidance for those countries needing to move to Tier 2 Livestock MRV
- Partnerships must be built on mutual trust, respect and ownership
- Extending networking, inviting other stakeholder to take part, awareness creation
- Engage media professionals to work together with researchers to collect data and give it to consumers
- Let it get to more public universities in Nigeria and other developing countries

Standards and Strategies

- Standardized baseline for smallholder soil carbon projects

- Clear practical strategies for scaling up and extending conservation processes must be developed
- Devising a simplified form may assist all concerned bodies to measure emission reduction
- Incentive mechanisms for incorporating MRV system at institution and project levels

- Identifying priority area for intervention
- Through development and design of programs to support MRV
- By covering the program wider range and more efficiently
- Methods. Pilot projects

Link to National Processes

- CCAFS research and support needs to be increasing scientists' contribution to MRV consistency with existing national processes, including the potential role of GHG inventories and sustainable development impacts, needs to be investigated and clarifies

- Aligning all project implementation with country's NDCs so that each and every emission reduction will be counted and reported

Conservation Measures/ Scientific Issues

- Sustainable water conservation measures should have realistic short- and medium-term gains to make them economically realistic and attractive
- Conservation planning should reflect extreme weather events, not just normal weather patterns
- There must be a consensus on the problems to be addressed, and the desired research and development aims
- Support some MRV project for rice, upland crops, and livestock
- Support for determining EF for new land use change (rice-rice to rice-shrimp, rice-upland crop)
- CCAFS can improve MRV by supporting continuous funding for conducting GHG emission research
- Strengthen livestock sector MRV systems and integrate them with AFOLU MRV system

Capacity Development

- Cross-disciplinary, adaptive learning processes for researchers and development workers to provide a continuum of research and development
- Through continuous capacity development
- Capacity building in universities
- Expansion of the capacity building especially workshops and education tours to CLIFF - GRADS beneficiaries
- By improved support to academic and research institutions
- Training or workshop (with virtual system) should be designed on MRV- or related-Tier 2 system of measuring emissions, on mitigation and adaptation concepts, as applied to the livestock or agriculture sectors
- Capacity building for relevant experts in developing countries like Ethiopia should be the first step. Experience sharing and networking with other countries is also helpful for implementing CCAFS research outcomes

M&E

- Continuous M&E for feedback

- MRV should be part of the project log frame (at design stage) and also part of M&E during implementation and supervision

Q9.2 Where has CCAFS research and support for MRV been most successful?

National Level

- At national level—there is little demand for MRV at lower levels
- Many countries including India, Poland, Vietnam, and the Netherlands
- Engaging with national agencies responsible for livestock mitigation and/or MRV, engaging with donor projects promoting GHG mitigation
- For agricultural and livestock sectors. Especially if it is useful to implement mitigation and adaptation measures and above all it can stimulate the economy of our country through carbon credit initiatives

Policy

- Engaging policy makers
- Policy dialogue

Opportunities

- Fellowship e.g., CLIFF-GRADS scholarship
- The CLIFF-GRADS program
- CCAFS research and support for MRV has been most successful for PhD candidates
- In most developing countries PhD research works

Scientific Support / Capacity Development

- Red River Delta and Mekong River Delta, Vietnam
- Tier 2 livestock development was the main achievement for CCAFS
- In paddy rice systems in Southeast Asia
- Enhancing capacities for MRV of sustainable livestock actions
- Building capacities for an integrated livestock MRV system
- Inventory of GHG emissions from cattle, sheep, and goats calculated using the Intergovernmental Panel on Climate Change (IPCC) Tier 2 approach
- Information and technology generation, socio-economic aspects, communication, and dissemination
- Climate-change adaptation and mitigation work
- In partnership with national government and private-sector champions to achieve quick wins e.g., Tier 2 GHG inventory in Ethiopia and Kenya, while supporting

capacity development to operate MRV systems and attracting private investments transform food systems in the long run

- Working with partners to deliver guidance useful for those working in Tier 2 Livestock MRV
- Capacity building and institutional development
- Capacity building and resources development
- Development of dairy NAMA concept in Kenya

Q9.3 What are priorities for future work on MRV in agriculture and food systems?

Tier 2 – Livestock sector

- Tier 2 MRV for Livestock
- Capacity building on the newly developed Tier 2 for all related experts as a nation will be the 1st priority area
- Updating the MRV system to Tier 2
- Streamlining integrated digital MRV systems in the Livestock Sector
- Capacity building in Tier- 2 livestock MRV system
- Capacity building in Livestock for GHG mitigation
- Livestock sector (2 responses)
- Livestock rearing impact
- Ruminant production
- Livestock (enteric fermentation in cattle)
- Focus more on Livestock production system

Food systems

- Research transform food systems, food loss, and food waste for mitigation is a priority for future work on MRV in agriculture and food systems
- Research to transform food systems closely together with government, development and impact finance, and the private sector, e.g., engaging with actors like Rabobank and Impossible foods
- Priorities for future work on MRV in agriculture and food systems need to be supported to investigate the potential role of sustainable development impacts from the use of pastoral land GHG inventories. In Africa, pastoral land use constitutes about 65% of the total land area and is the major source of feed for ruminants, which supports 59% of all ruminant livestock. However, pastoral land use is

undergoing severe degradation, consequently pastoralism is rarely viewed as an important form of future land use. Indeed, economic valuation efforts and the development of policies is limited. Therefore, rather than abandoning pastoralism, the revitalization of traditional practices and indigenous knowledge is vital to secure sustainable livelihoods for millions of pastoralists, to maintain pastoral land use, and to mitigate and adapt climate-change impacts.

- Impact and quantification of food waste reduction
- Food security in Sub-Saharan Africa, value chains, extending capacity building, and application of digitalize farming.

National systems

- National systems for implementing the Enhanced Transparency Framework.
- MRV in agriculture work should be considered a national priority program in agriculture
- Linking MRV with policy implementation and sources of finance so that MRV improvements link to investment and action.

Agriculture

- Paddy rice (2 responses)
- Nutrient management for crop production, etc.
- Education on awareness raising for smallholder farmers
- Fertilizer use, pesticide use, and impact from farming practices
- Potential new mitigation synergies between agricultural production and GHG mitigation such as biochar
- Climate-smart agricultural practices, low emissions livestock interventions, and improving health systems of the livestock sectors are some of the priorities that have to be considered in the context of Ethiopia

Miscellaneous

- Communities, media, policy makers and scientists
- Climate change
- Ecosystems health
- Gender issues
- Postdoctoral openings
- Agroforestry
- Connecting mitigation project and carbon market

Annex V. List of Key Informants

1. Durba Kashyap, 2020 CLIFF-GRADS student, National Institute of Food Technology and Entrepreneurship and Management (NIFTEM), India, November 23, 2020
2. Meseret Teweldebrihan, 2020 CLIFF-GRADS student, Haramaya University, Ethiopia, University of Johannesburg, South Africa, November 24, 2020
3. Sani Idris, 2020 CLIFF-GRADS student, Ahmadu Bello University, Zaria, Nigeria, Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina, Nigeria, November 24, 2020
4. Funmilola Adebisi, 2021 CLIFF-GRADS student, National Space Research and Development Agency (NASRDA), Nigeria, November 25, 2020
5. Abera Assefa Biratu, 2020 CLIFF-GRADS student, Ethiopian Institute of Agricultural Research Ethiopia, November 25, 2020
6. Timm Tennigkeit, UNIQUE Germany, November 25, 2020
7. Mai Van Trinh, IAE, Vietnam, November 26, 2020
8. Taiwo Bintu Ayinde, 2013-2014 CLIFF-GRADS student, Samaru College of Agriculture, Division of Agricultural Colleges Ahmadu Bello University (ABU) Zaria, Nigeria, November 30, 2020
9. Jean Baptiste Dolle, Institut de l'Elevage (idele), France, December 1, 2020
10. Jacobo Arango, Alliance of Bioversity and CIAT, Colombia, December 2, 2020
11. Andy Wilkes, Values for development Ltd, United Kingdom and Timm Tennigkeit, Germany, December 4, 2020
12. Alexandre Berndt, EMBRAPA, Brazil, December 4, 2020
13. Susan Nguku, 2021 CLIFF-GRADS student, Ministry of Agriculture Water and Irrigation, Kenya, December 7, 2020
14. Dong Hongmin, Institute of Environment and Sustainable Development in Agriculture, CAAS, China, December 15, 2020
15. Ole Sander, IRRI, Vietnam, December 17, 2020

Annex VI. Country-specific Harvested Outcomes

Outcome CCAFS-01: Brazil - Enhanced Technical Capacity

CCAFS' support and resources have helped EMBRAPA to: (1) enhance technical capacity for MRV of livestock, and (2) shape the MRV of a particular livestock initiative in Brazil.

CCAFS supported the travel of Brazilian scientists, participating as representatives of the Brazilian government, to MRV events at COP22 (2016) and, with the support from UNIQUE (Andy Wilkes), to a Livestock MRV event hosted by FAO. The knowledge sharing and networking from both events broke new ground for Brazil and, with the support of CCAFS resources including Measurement, reporting and verification of livestock GHG emissions by developing countries, led to the launch in 2020 of "Carbon-free meat", a labelling initiative linked to livestock and emissions reduction in the private sector, and which will also include a label for products destined for export.

Outcome type: Cluster 9: Capacity Building

Contribution: CCAFS and UNIQUE support for travel for EMBRAPA staff to COP22 (2016) and a Livestock MRV event hosted by FAO catalyzed increased interest for MRV initiatives in Brazil.

Relevance: Catalytic

Societal Actors:

- Type I Implementing Partners: EMBRAPA
- Type II Government: Ministério da Agricultura, Pecuária e Abastecimento
- Type III Private: Marfrig [*https://www.marfrig.com.br/*]; UNIQUE
- Type IV Funding Agencies:

Geographic scope: Brazil

Outputs: (2020) Carbon-free meat. Brazilian government website [in Portuguese]: Brasil tem primeira linha de produtos carne carbono neutro

Informant: Alexandre Bernd, EMBRAPA

Outcome CCAFS-02: China - Tier 2 Guidance and Private Sector Engagement through Partnership with CCAFS

China had a GHG reporting system for the livestock sector. They had an expert review panel, but no MRV guidelines specific to China's livestock sector. In 2018, a partnership was formed between the Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences (IEDA-CAAS), NCSC, the Ministry of Ecology and Environment with CCAFS, which led to the development of the Provincial Guidance for Measurement, Reporting and Verification of Greenhouse Gas Inventory in China's livestock based on IPCC Tier 2 method — Dairy cattle and Swine, published in 2020. The guide is supported by a handbook and both were rolled out over a series of seven training events involving over 1,300 participants who were responsible for GHG inventory of livestock sectors, including participants form the Ministry of Agriculture and Rural Development, large farms, and provisional authority for GHG, to build capacity among stakeholders at the provincial level. The Tier 2 guidance also include mitigation actions. For example, they are able to assess the impact of low-protein feed and the biogas utilization impact on the mitigations. Within Tier 1, this influence was not possible to measure. There are also mitigation actions linked to manure utilization and the dairy industry. The Tier 2 MRV guidance for GHGs relevant to the livestock sector will also provide methodological support for implementation of China's NDC in the agricultural sector.

Carbon market allowance allocation and management training, China, 2019. Source: Dr. Dong Hongmin

Private Sector Engagement

With CCAFS support, China developed the Carbon Footprint Assessment and Mitigation Options of Dairy under Chinese Conditions Report, which includes a software tool for the Chinese dairy sector. It was presented at the Sino-Dutch Dairy Development Centre in November 2019. Following the meeting, Nanjing Weigang Dairy Co., Ltd. the milk supplier to Starbucks Corporation in China, sought support to use the tool to calculate the GHG emissions and mitigations deriving from their production process. Starbucks embraced the initiative as it will help them achieve their emissions reduction target, which is to reduce their Carbon Footprint by 30% from 2018 to 2030. In 2020, IEDA-CAAS initiated discussions with The Nature Conservancy on low-carbon emissions from dairy farming, and through this connection they are now in discussions with the Nestlé Dairy Farming Institute (DFI) about their emissions reduction potential.

Outcome type:

- Cluster 2: Tier 2 MRV in Livestock
- Cluster 3: Country-focused MRV

Contribution: CCAFS has partnered with IEDA-CAAS to support the development of Tier 2 MRV guidance. CCAFS has also provided improved capacity to government ministries through the organization of workshops and trainings with international experts and provided support in the production of publications and guidelines.

Relevance: Partnership

Societal Actors:

- **Type I Implementing Partners:** Institute of Environment and Sustainable Development in Agriculture, CAAS; CCAFS
- Type II Government: NCSC
- **Type III Private:** Starbucks Corporation and DFI of Nestlé

- **Type IV Funding Agencies**: New Zealand Government

Geographic scope: China

Outputs:

- **2018:** Hongmin D. Tier 2 MRV of livestock emissions in China: Developing guidance for implementation at the provincial level. In: Kick off meeting CCAFS project CHINA, the Chinese Academy of Agricultural Sciences (CAAS), Beijing, China, October 12 & 16.
- **2019:** Publication Carbon Footprint Assessment and Mitigation Options of Dairy under Chinese Conditions
- **2020:** Publication Provincial Guidance for Measurement, Reporting and Verification of Greenhouse Gas Inventory in China's livestock, based on IPCC Tier 2 method —Dairy cattle and Swine

Informants: Dong Hongmin, Institute of Environment and Sustainable Development in Agriculture, CAAS

Outcome CCAFS-03: Columbia - Innovations in Agriculture Lowers Emissions

Over the past several years, CCAFS —through CIAT —has worked collaboratively with the Colombian Government to achieve the NDC goal of reducing national GHG emissions by 20%. Toward this goal, CCAFS-CIAT has made key contributions designed to support policy needs and the transition from a Tier 1 to a Tier 2 reporting of GHGs and carbon sequestration, resulting in an improved national GHG inventory that acknowledges CIAT's contribution.

Contributions include:

- **Improvement of MRV to include into the accounting process.** In addition to reduced emissions, this also fights land degradation.
- **CCAFS inputs to the carbon credit scheme.** CCAFS received an acknowledgement letter from the Colombian Government with regard to their technical feedback on a

carbon credit scheme. The resulting system requires all organizations working in GHG mitigation to register on the *RENARE* platform and use their standards.

- **RUMINANT: a model that informed the NAMA for livestock**. *RUMINANT* is an animal-level model and software tool that can estimate ruminant emissions. It works by analyzing the quality of the diet, to provide estimates of methane emissions, which is a quicker and more cost-effective method than measuring methane in the field. The tool was originally developed for Africa and was calibrated by CCAFS and CIAT for application in Colombia. The benefits to Colombia were threefold: (1) improved capacity to livestock sector which resulted in an improvement in feed with lower GHG impacts; (2) enhanced productivity of livestock linked to improved feed; and (3) climate change mitigation by informing decisions on the mitigation measures within the livestock sector, and the policy commitments. For example, RUMINANT was used to formulate the NAMA Information Note that informed the design of the NAMA for the livestock sector. By using the RUMINANT model, the government has identified strategies that could potentially reduce methane emissions by 20%, which directly supports Colombia's NDC goal.
- **Ganadería Sostenible (GANSO): Sustainable value chains leading to lower emissions.** *GANSO* is an NGO that was conceived by CIAT, CCAFS and *Climate Focus* in 2018; it provides technical and financial assistance to farms to help them improve efficiency through diversification in a sustainable way. This is done through their business model, which links financial returns for investments. GANSO has recently launched a voluntary program for producers to assess their sustainability. Improved efficiency and increased sustainability will ultimately lower emissions and provide valuable inputs for policy implementations for the Colombian Government.

CCAFS-CIAT's strategic partnership with The Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), which sits under Colombia's Ministry of Environment and is responsible for the country's climate and environmental information, has been a key factor for success. Close collaboration ensures the successful transfer of CCAFS-CIAT innovations into MRV practice. According to the CCAFS Info Note, "Scaling up the use of low-emissions development (LED) research outputs in Colombia", IDEAM has strived to reduce uncertainties in emission estimations linked to nitrogen fertilizer. Improved data collection

provides the evidence needed to make strategic decisions in the realm of LED, which is linked to prioritized mitigation options and an improved GHG inventory for the third national communication on climate change (Chapter 2 Page 16), the second BUR (page 87) and National Inventory Report (page 298) submitted to the UNFCCC in 2017, 2018, and 2019, respectively.

Outcome type:

- Cluster 2: Tier 2 MRV in Livestock
- Cluster 3: Country-focused MRV
- Cluster 5: MRV for smallholder farmers

Contribution: Through close partnership with MADS and MADR, CCAFS-CIAT was able to test and launch a variety of initiatives in Columbia and support the transition from a Tier 1 to a Tier 2 reporting of GHGs and carbon sequestration, resulting in an improved national GHG inventory which acknowledges CIAT.

Relevance: Partnership

Societal Actors:

- Type I Implementing Partners: CIAT, CCAFS, IDEAM
- Type II Government: MADS, MADR
- Type III Private:
- **Type IV Funding Agencies:** USAID
  Geographic scope: Colombia with reach to Panama, Peru, and other countries in Latin America

MRV System Improvement:

- **2016:** CCAFS input to carbon credit scheme; acknowledged by letter from the Colombian Government
- **2020**: Inclusion of a silvopastoral system and carbon accumulations into the MRV accounting process

Outputs:

- **2016**: CCAFS/-CIAT partners with IDEAM
- **2018:** Ruden A, Serna L, Gaviria X, Sotelo M, Gutiérrez JF, Trujillo C, Mazabel J, et al. **2018**: Model of enteric methane emissions supports climate change mitigation in Colombia's cattle sector. CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
- **2019:** Camacho K. An evaluation of the outcomes of the calibration and validation of the RUMINANT Model for Colombia. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food (CCAFS).
- **2019**: Suber M, Gutiérrez Beltrán N, Torres CF, Turriago JD, Arango J, Banegas NR, et al. Mitigación con Sistemas Silvopastoriles en Latinoamérica. Aportes para la incorporación en los sistemas de Medición Reporte y Verificación bajo la CMUNCC. CCAFS Working Paper no. 254. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
- **2020:** Aynekulu, E, Suber, M, van Noordwijk, M, Arango, J, Roshetko, JM, and Rosenstock TS. Carbon Storage Potential of Silvopastoral Systems of Colombia. *Land* **2020**, *9*, 309. https://doi.org/10.3390/land9090309
- **2020:** Ruden A, Castro JP, Gutiérrez JF, Koenig S, and Arango J. GANSO: New business model and technical assistance for the professionalization of sustainable livestock farming in the Colombian Orinoquia region. CCAFS Info Note. Cali, Colombia: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Informants:

- Jacobo Arango, Alliance of Bioversity and CIAT
- Alejandro Ruden, Alliance of Bioversity and CIAT
- Felipe Torres [ftotri@gmail.com], responsible for the Agriculture section of the Colombian GHG inventory

Outcome CCAFS-04: Cuba - Estimates GHG Emissions and moves to Tier 2 Reporting

Under the framework of a CCAFS project, Cuba brought together experts from CCAFS, CIAT and Clima Soluciones to provide capacity to over 30 stakeholders on how to estimate GHG

emissions in the AFOLU sector. The workshop, which included a modeling approach, helped the country move from a Tier 1 to Tier 2 reporting.

CCAFS teamed up with CAC in the organization of a webinar to share the experiences in Cuba with relevant actors in Latin America.

Outcome type:

- Cluster 3: Country-focused MRV
- Cluster 7: Other land use

Contribution: CCAFS provided expert advice to the AFOLU sector in Cuba and capacity building, which helped the country transition from Tier 1 to Tier 2 reporting. Through a partnership between CCAFS and CAC, the information was shared with relevant actors in Latin America. All knowledge and lessons learned in Colombia were then transferred to Cuba, which makes Cuba an indirect beneficiary to the CCAFS work.

Relevance: Partnership

Societal Actors:

- **Type I Implementing Partners:** CIAT, CCAFS, Clima Soluciones
- **Type II Government**: Cuban Government
- Type III Private:
- Type IV Funding Agencies: USAID

CAC was also involved in disseminating the results of the training through a webinar.

Geographic scope: Cuba

Outputs:

- **2019: Capacity Building for Cuba to estimate GHG**
- **2019:** CAC organizes a webinar to share the experiences in Cuba with relevant actors in Latin America.

Informants:

- Jacobo Arango, Alliance of Bioversity and CIAT
- Alejandro Ruden, Alliance of Bioversity and CIAT

Outcome CCAFS-05: Ethiopia - Adoption of Tier 2 GHG inventory for cattle, sheep, and goats with support from CCAFS

In 2020, Ethiopia validated and adopted a Tier 2 GHG inventory for cattle, sheep, and goats produced entirely with support from CCAFS. The inventory is currently in publication. It will be used to calculate the national GHG inventory in Ethiopia's next official submission to the UNFCCC. The UNFCCC submission has been delayed from 2020 and is due to start in 2021.

The Tier 2 inventory data, including animal population numbers and emission factors, has been used by the World Resources Institute and other consultants to develop Ethiopia's long-term development strategy. The Tier 2 inventory data will also be incorporated into the NDC. The NDC update has been submitted and a technical report documenting these changes is due in February 2021 and will be shared once available.

UNIQUE and CCAFS supported the transition to Tier 2 through capacity building, using the following resources:

- Tier 2 inventory approaches in the livestock sector: A collection of agricultural greenhouse gas inventory practices, authored by UNIQUE, with support from CCAFS, GRA and the New Zealand Government
- Livestock development and climate change: the benefits of advanced greenhouse gas inventories, produced by CCAFS and GRA
- FAO and Global Research Alliance on Agricultural Greenhouse Gases. 2020. Livestock Activity Data Guidance (L-ADG): Methods and guidance on compilation of activity data for Tier 2 livestock GHG inventories. Some of the case studies in the L-ADG were based on analysis of data from CCAFS surveys (e.g., Tables 13, 17, and 18). The research was funded by and the publication produced in collaboration with CCAFS and UNIQUE.

Some quantifications towards impact:

Project	Investment	Beneficiaries	Emissions Reduction
OFLP ETHIOPIA	US$ 18 million development grant (approx. value)	1.8 million people living in or near forest	15.46 million mtCO2e This is the forest component. Livestock component not yet known
LFSDP	US$176 m	1.2 million households	1.7 million mtCO2e

Outcome type:

- **Cluster 1:** General resources on MRV and GHG measurement
- **Cluster 2:** Tier 2 MRV in Livestock
- **Cluster 3:** Country-focused MRV
- **Cluster 4:** East Africa MRV for livestock and dairy
- **Cluster 5:** MRV for smallholder farmer
- **Cluster 7:** Other land use
- **Cluster 8:** MRV for the finance sector

Contribution: CCAFS and UNIQUE have supported the Ethiopian Ministry of Environment in adopting the Tier 2 methodology, which will be used in calculating the national GHG inventory in Ethiopia's next submission to the UNFCCC. The Tier 2 data will also be incorporated into the NDC, and is mentioned in the NDC update.

Relevance: Lead

Societal Actors:

- **Type I Implementing Partners:** UNIQUE, CCAFS, The World Resources Institute (Netherlands), GRA; World Bank; New Zealand Government; FAO; Ethiopian Institute for Agricultural Research
- **Type II Government:** Ethiopia Ministry of Environment
- Type III Private:
- **Type IV Donors:** USAID; New Zealand Government; World Bank; US Forestry Service

Geographic scope: Ethiopia

MRV System Improvement:

- **2021:** Tier 2 inventory for Oromia region (World Bank, United States Forest Service [USFS])
- **2021:** Operationalizing livestock GHG intensity results framework indicator of LFSDP (World Bank, USFS)

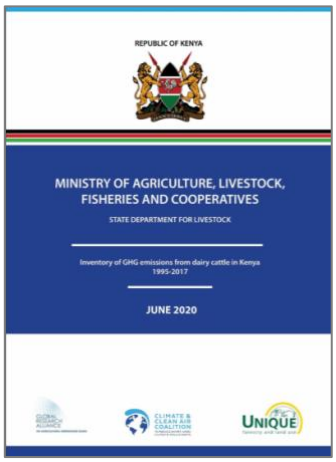
Extended list of country level interventions:

- **2021:** Tier 2 inventory will be used in BUR; improvement in National GHG inventory (MoA; EFCCC)
- **2021:** Tier 2 inventory data used in Ethiopia's long-term development strategy and NDC and revised accounting methodology used in NDC

Informants:

- Timm Tennigkeit, UNIQUE
- Andy Wilkes, UNIQUE

Outcome CCAFS-06: Kenya - Leading transition towards Tier 2



Kenya adopted a Tier 2 method for dairy cattle in its national GHG inventory with support from CCAFS. The inventory was compiled with financial support GRA, but one of the three dairy production systems represented in the inventory was primarily characterized using data from a CCAFS survey: Methods and guidance to support MRV of livestock emissions: Methods for data collection, analysis and summary results from a pilot baseline survey for the Kenya dairy NAMA. The National GHG Inventory report refers to the CCAFS survey.

Validation of the estimated emission factors in the inventory (Section 2.4 in the national inventory report) was accomplished using the Cattle Methane Similarities Calculator, which

is part of the MRV Platform for Agriculture (AgMRV) website that CCAFS led together with GRA, and which is referenced in the national inventory report as Thorley et al. 2019.

Tier 2 inventory approaches in the livestock sector: A collection of agricultural greenhouse gas inventory practices and Livestock development and climate change: the benefits of advanced greenhouse gas inventories have been used in trainings for the development of Kenya's Tier 2 GHG inventory, in training for Ethiopia's Tier 2 inventory, and in a recent training for Zimbabwe to plan a Tier 2 inventory.

Outcome type:

- **Cluster 1:** General resources on MRV and GHG measurement
- **Cluster 2:** Tier 2 MRV in Livestock
- **Cluster 3:** Country-focused MRV
- **Cluster 4:** East Africa MRV for livestock and dairy
- **Cluster 5:** MRV for smallholder farmer
- **Cluster 7:** Other land use
- **Cluster 8:** MRV for the finance sector

Contribution: CCAFS and UNIQUE have been recognized for their contribution to the Kenya Ministry of Agriculture, Livestock, Fisheries and Cooperatives, "Inventory of GHG emissions from dairy cattle in Kenya 1995-2017", via their support for adopting the Tier 2 methodology and validating the emission factors by using the Cattle Methane Similarities Calculator.

Some quantifications from the project towards impacts

Project	Investment	Beneficiaries	Emissions Reduction
Livelihoods Mt Elgon project	Confidential	30,000	1 million mtCO2e
KCSAP	US$ 280 m	521,500 households	5.5% reduction target (total volume not known)

NARIGP	US$ 219 m	360,000 households with average of 5-8 members per household	No target

Relevance: Lead

Societal Actors:

- **Type I Implementing Partners:** UNIQUE, CCAFS, GRA; World Bank, FAO
- **Type II Government:** Kenyan Ministry of Agriculture, Livestock, Fisheries and Cooperatives; New Zealand Government
- Type III Private:
- **Type IV Funding Agencies:** New Zealand Government, USAID, World Bank, FAO

Geographic scope: Kenya

Investment impacted by CCAFS:

- **2016:** Mt Elgon project applies GS Smallholder Dairy Methodology
- **2016:** Reduced GHG intensity becomes a results framework indicator
- **2018:** Gold Standard smallholder dairy methodology has been used in the Livelihoods Mt Elgon project, and in a World Bank Livestock Development Project in Bangladesh. It has been written into the M&E manual for the World Bank Kenya Climate-Smart Agriculture Project and NARIGP, also in Kenya.
- **2018:** Government of Kenya. National Climate Change Action Plan (Kenya) 2018-**2022**: Ministry of Environment and Forestry, Nairobi, Kenya.
- **2019**: Cattle Methane Similarities Calculator
- **2019: CCAFS Working Paper 285:** Methods and guidance to support MRV of livestock emissions: Methods for data collection, analysis and summary results from a pilot baseline survey for the Kenya dairy NAMA.
- **Pending Publication**: Manual for GHG quantification
- Pending Publication: OFLP MRV system

Policy impacted by CCAFS work

- **2018:** Second National Climate Change Action Plan Issued by the Ministry of Environment, which includes Dairy NAMA

MRV system improvement

- **2018:** Smallholder methodology written into KCSAP M&E system (World Bank/UNIQUE)
- **2019**: Tier 2 dairy GHG inventory compiled (UNIQUE/GRA) [Inventory of GHG Emissions from Dairy Cattle in Kenya 1995-2017]

Outputs:

- **2017:** Tully K L, Abwanda S, Thiong'o M, Mutuo PM, and Rosenstock T.S. 2017. Nitrous oxide and methane fluxes from urine and dung deposited on Kenyan pastures. Journal of environmental quality, 46(4): 921-929.
- **2017:** Kenya Dairy NAMA MRV system Concept Note (UNIQUE/CCAFS)

Extended list of country level interventions:

- **2014:** NAMA scoping in Kericho County (UNIQUE/CCAFS)
- **2014:** Consultation on dairy NAMA (UNIQUE/CCAFS)
- **2015:** Diary NAMA support coordination meeting (UNIQUE/FAO)
- **2015:** NAMA Steering Committee established (UNIQUE/CCAFS/FAO)
- **2015:** CCAFS approves NAMA dairy project
- **2015:** Mt. Elgon Sustainable Land Management/Dairy project designed (UNIQUE)
- **2016:** Smallholder dairy methodology approved (FAO/ International Livestock Research Institute /UNIQUE)
- **2016:** NAMA baseline and mitigation scenario assessment (UNIQUE/FAO)
- **2017:** NAMA GCF proposal approved in NT pipeline with IFAD as AE (UNIQUE/CCAFS)
- **2017:** Baseline survey for NAMA in central Kenya (UNIQUE/CCAFS/FAO)
- **2018:** Stakeholder consultation on Tier 2 dairy GHG inventory (UNIQUE/FAO/GRA)
- **2018:** Kenya/Ethiopia MRV project approved (CCAFS)
- **2019:** Compile livestock activity data guidance (UNIQUE/FAO/CCAFS/GRA)
- **2019:** KCSAP Monitoring & Evaluation
- **2020:** Dairy GHG data collection written into NARIGP M&E System (UNIQUE/World Bank)
- **2021:** Tier 2 inventory training (UNIQUE/GRA)
- **2021:** Updated Tier 2 dairy GHG inventory (UNIQUE/GRA)
- **2021:** Tier 2 inventory webinar (UNIQUE)

Informants:

- Timm Tennigkeit, UNIQUE
- Andy Wilkes, UNIQUE

Outcome CCAFS-07: Vietnam - Strong partnership and capacity development leads to increased sustainability and resilience in the rice sector

The partnership and collaboration between CCAFS/IRRI and the Ministry of Agriculture and Rural Development (MARD) of Vietnam contributed to the dissemination of evidence-based innovations through the development of guidelines and capacity building aimed at combating climate change and making rice production practices more sustainable and resilient. CCAFS/IRRI contributions include support to the NDC (2016) and their revision (2020). Furthermore, the scaling out of their Alternate Wetting and Drying technology has resulted in a reduction of 1 million tCO_2e/yr, as reported for 2019.

The pathway to change has been achieved through the development of scientific evidence, the dissemination of evidence through guidelines and tools, and targeted capacity building to ensure take-up and mainstreaming. Milestone developments over the past decade include:

Improvements in Measurements through Capacity Support

IRR/CCAFS established two **GHG laboratories** in Vietnam. Capacity support to the labs, between 2011 and 2016, ranged from building the infrastructure, to training events on sampling, following methodologies for measurements, quality assurance, and quality control. The laboratories have been able to raise their own funds to support MRV research.

A new pilot on **Improved Crop Reporting**, extends capacity to supporting IT systems and a transition from pen and paper to managing the data in an electronic system. This change has impacted efficiency, reduced errors, and increased access to data.

Moreover, IRRI/CCAFS **provides support to MSC and PhD students in Vietnam** including three **CLIFF-GRADS,** a scholarship program with a research focus on agricultural GHG emissions quantification and mitigation. The students are able to build capacity through field experiments on measuring GHG emissions from farming and land management systems.

The MRV Toolbox

The MRV Toolbox was developed by IRRI, CCAFS and the Climate and Clean Air Coalition, and provides a gateway to access a variety of tools and resources on GHG inventories, mitigation projects, assessments and evaluations that have been developed over the last five years including:

- GHG Measurement Guidelines, notably:
    - Vietnam's national guidelines on GHG measurements (2016) supported by CCAFS/IRRI
    - Quantifying Greenhouse Gas Emissions (2016)
- SECTOR Greenhouse Gas Calculator for Rice and User Manual
- Rice CBA, a Cost Benefit Tool co-developed by UNIQUE
- GHG questionnaire for farmers and service providers
- Mapping suitability of the Alternate Wetting and Drying (MapAWD and User Manual), which can be used to plan and implement low-carbon rice production
- Monitoring and reporting tool for rice production (RiceMo)

As part of the MRV Toolbox launch, three training events were organized in late 2020, where stakeholders and decision makers from MARD, various research institutes, academies, and universities were trained on a variety of tools including MapAWD, SECTOR, Rice-CBA and RiceMo.

Support provided for the 2020 NDC Implementation

IRRI/CCAFS have mapped suitable rice areas for AWD across Vietnam in partnership with IAE between 2018 and 2020. IAE is also involved in national Ag-NDC planning. A consultation workshop was held in August 2020 in which IRRI and other CGIAR centers in Vietnam proposed to MARD different mitigation options to contribute to the NDC implementation. For the rice sector, mitigation packages including AWD irrigation technique, straw management, and converting rice land to other farming practices were presented together with their mitigation potential and other benefits.

In further support of the NDC, CCAFS, IRRI, and MARD have partnered to produce, "An investment plan for low-emission rice production in the Mekong River Delta region in support of Vietnam's Nationally Determined Contribution to the Paris Agreement". This Working Paper focuses on the use of alternate wetting and drying (AWD), which can ultimately lead to increasing a farmers' income by decreasing the production costs. The proposed investment plan would cover 900,000 hectares and mitigate 10.91 MtC02e.

Outcome type:

- **Cluster 1**: General resources on MRV and GHG measurement
- **Cluster 2**: Tier 2 MRV in Livestock
- **Cluster 6**: MRV and paddy rice
- **Cluster 9**: Capacity Building

Contribution: CCAFS/IRRI - through partnership with MARD - have scaled out MRV innovations, supported the NDC, and contributed to emissions reductions through AWD.

Relevance: Partnership

Geographic scope: Vietnam

Investment impacted by CCAFS:

- **2015 – ongoing**: MRV Labs are able to able to obtain new project funds

Policy impacted by CCAFS:

- **2016**: Support NDC through workshops and capacity building
- **2020**: Support NDC through workshops and capacity building

MRV System Improvement:

- **2011-2016**: Establishment of MRV Labs; infrastructure support and capacity
- **2016**: Vietnam's national guidelines on GHG measurements
- **2017-2019**: Suitability mapping

Outputs:

- **2016**: Butterbach-Bahl K, Sander BO, Pelster D, Díaz-Pinés E. (2016) Quantifying Greenhouse Gas Emissions from Managed and Natural Soils. In: Rosenstock T., Rufino M., Butterbach-Bahl K., Wollenberg L., Richards M. (eds) Methods for Measuring Greenhouse Gas Balances and Evaluating Mitigation Options in Smallholder Agriculture. Springer, Cham. https://doi.org/10.1007/978-3-319-29794-1_4
- **2017**: Azeem Tariq, Quynh Duong Vu, Lars Stoumann Jensen, Stephane de Tourdonnet, Bjoern Ole Sander, Reiner Wassmann, Trinh Van Mai, Andreas de Neergaard,Mitigating CH4 and N2O emissions from intensive rice production systems in northern Vietnam: Efficiency of drainage patterns in combination with rice residue incorporation, Agriculture, Ecosystems & Environment, 249: 101-111, https://doi.org/10.1016/j.agee.2017.08.011.
- **2017**: Padre, Agnes & Dang Hoa, Tran & Nghia, Hoang & Duong, Hau & Ngan, Tran & Le Van, An & Minh, Ngo & Wassmann, Reiner & Sander, Bjoern Ole. (2017). Measuring GHG Emissions from Rice Production in Quang Nam Province (Central Vietnam): Emission Factors for Different Landscapes and Water Management Practices. 10.1007/978-981-10-2624-9_7
- **2017**: Thi Bach Thuong Vo, Reiner Wassmann, Agnes Tirol-Padre, Van Phuong Cao, Ben MacDonald, Maria Victoria O. Espaldon, and Bjoern Ole Sander (2018) Methane emission from rice cultivation in different agro-ecological zones of the Mekong river delta: seasonal patterns and emission factors for baseline water management, Soil Science and Plant Nutrition, 64:47-5. DOI: 10.1080/00380768.2017.1413926

- **2018**: Azeem Tariq, Andreas de Neergaard, Lars Stoumann Jensen, Bjoern Ole Sander, Mai Van Trinh, Quynh Duong Vu, Reiner Wassmann, Stephane de Tourdonnet, Co-design and assessment of mitigation practices in rice production systems: A case study in northern Vietnam, Agricultural Systems, 167:72-82. https://doi.org/10.1016/j.agsy.2018.08.012.
- **2018**: Azeem Tariq, Lars Stoumann Jensen, Bjoern Ole Sander, Stephane de Tourdonnet, Per Lennart Ambus, Phan Huu Thanh, Mai Van Trinh, Andreas de Neergaard, Paddy soil drainage influences residue carbon contribution to methane emissions, Journal of Environmental Management, 225:168-176. https://doi.org/10.1016/j.jenvman.2018.07.080.
- **2018**: Thi Bach Thuong Vo, Reiner Wassmann, Agnes Tirol-Padre, Van Phuong Cao, Ben MacDonald, Maria Victoria O. Espaldon & Bjoern Ole Sander (2018) Methane emission from rice cultivation in different agro-ecological zones of the Mekong river delta: seasonal patterns and emission factors for baseline water management, Soil Science and Plant Nutrition, 64:1, 47-58, DOI: 10.1080/00380768.2017.1413926
- **2019**: Nguyen-Van-Hung, Sander, B.O., Quilty, J. et al. An assessment of irrigated rice production energy efficiency and environmental footprint with in-field and off-field rice straw management practices. *Sci Rep* 9. https://doi.org/10.1038/s41598-019-53072-x
- **2019**: Working Paper No. 263. An investment plan for low-emission rice production in the Mekong River Delta region in support of Vietnam's Nationally Determined Contribution to the Paris Agreement.
- **2020**: MRV Toolbox: MapAWD, SECTOR, Rice-CBA and RiceMo
- **2020**: Methane Emission Factors from Vietnamese Rice Production: Pooling Data of 36 Field Sites for Meta-Analysis. *Climate* 2020, *8*(6), 74. Read more here

Informants:

- Dr. Mai Van Trinh, IAE
- Dr. Ole Sander, IRRI
- Trang Vu, IRRI

Societal Actors:

- Type I Implementing Partners: IAE, CCAFS, IRRI
- Type II Government: IAE

- Type III Private:
- **Type IV Funding Agencies**: CCAC; GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit / German Society for International Cooperation; MAFF of Japan; Climate Technology Centre and Network

Annex VII. List of MRV Evidence Submitted

China

1. **2019:** Carbon market allowance allocation and management series training courses (in Chinese)
    - October 25–27, 2019
    - October 31–November 2, 2019
    - November 2–November 4, 2019
    - November 14–15, 2019
    - November 25–26, 2019
2. **2018:** Hongmin D. Tier 2 MRV of livestock emissions in China: Developing guidance for implementation at the provincial level. In: Kick-off meeting CCAFS project CHINA, the Chinese Academy of Agricultural Sciences (CAAS), Beijing, China, October 12 & 16 2018.
3. **2019:** Monitoring, reporting, certification methods and emission reduction technology options of greenhouse gas emissions from livestock production in China, Meeting Agenda, October 21, 2019, Chinese Academy of Agricultural Sciences, Beijing, China.
4. **2019:** Carbon Footprint Assessment and Mitigation Options of Dairy under Chinese Conditions
5. **2020:** Invitation Letter to Prof. Dong for GHG Workshop
6. **2020:** Provincial Guidance for Measurement, Reporting and Verification of Greenhouse Gas Inventory in China's livestock based on IPCC Tier 2 method– Dairy cattle and Swine

Colombia

1. **2015:** Information Note of the Sustainable Bovine Livestock NAMA. November.
2. **2018:** MRV contributions appreciation for the Livestock Plus from MADS (Ministry of Environment, Colombia), Email, 6 August.
3. **2018:** Ruden A, Serna L, Gaviria X, Sotelo M, Gutiérrez JF, Trujillo C, Mazabel J, Quintero S, Villegas D, Tapasco J, Richards M, Chirinda N, Arango J. Model of enteric methane

emissions supports climate change mitigation in Colombia's cattle sector. CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

4. **2019:** Camacho K. An evaluation of the outcomes of the calibration and validation of the RUMINANT Model for Colombia. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food (CCAFS).
5. **2019:** Suber M, et al. Mitigación con Sistemas Silvopastoriles en Latinoamérica. Aportes para la incorporación en los sistemas de Medición Reporte y Verificación bajo la CMUNCC. CCAFS Working Paper no. 254. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
6. **2020:** Aynekulu E, Suber M, van Noordwijk M, Arango J, Roshetko JM, Rosenstock TS. Carbon Storage Potential of Silvopastoral Systems of Colombia. *Land*, *9*, 309. https://doi.org/10.3390/land9090309
7. **2020:** Ruden A, Castro JP, Gutiérrez JF, Koenig S, Arango J. GANSO: New business model and technical assistance for the professionalization of sustainable livestock farming in the Colombian Orinoquia region. CCAFS Info Note. Cali, Colombia: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Ethiopia

1. **2020:** Meseret Teweldebrihan, 2020 CLIFF-GRADS, Haramaya University, Ethiopia, University of Johannesburg, South Africa, 24 November 2020 GHG emissions and abatement using implemented practices in Ethiopia, Abera Assefa Biratu, PhD student at Haramaya University and fellow of CLIFF-GRADS capacity building program hosted by CCAFS and GRA.

2. **2018:** The Federal Democratic Republic of Ethiopia, The Second Growth and Transformation Plan (GTP II), Midterm Review Report, National Planning Commission, June 2018, Addis Ababa, Ethiopia
3. **2021:** Abera Assefa Biratu, Bobe Bedadi, Solomon Gebreyohannis Gebrehiwot, Tilahun Hordofa, Desale Kidane Asmamaw & Assefa M. Melesse (2021) Implications of land management practices on selected ecosystem services in the agricultural landscapes of Ethiopia: a review, International Journal of River Basin Management. DOI: 10.1080/15715124.2020.1870991

France

1. **2019:** Partnerships for dairy and beef low-carbon initiatives in France, French Livestock Institute, Jean-Baptiste Dollé, Andurand Josselin, Brocas Catherine, Castellan Elisabeth, Geslain Thierry, Guinot Caroline, Moreau Sindy, Velghe Mathieu. http://idele.fr/fileadmin/medias/Low_Carbon_dairy_beef_farms.pdf
2. **2020:** Scaling-up mitigation in the French livestock sector, Jean Baptiste Dollé, Institut de l'Elevage – French Livestock Institute, Bioeconomy and Climate Action in rural areas. https://enrd.ec.europa.eu/sites/default/files/tg2_beca_france_dolle.pdf

Nigeria

1. **2020:** Ayinde TB, Ahmed B, Nicholson CF. Farm-Level Impacts of Greenhouse Gas Reductions for the Predominant Production Systems in Northern Nigeria. In: Leal Filho W, Ogugu N, Adelake L, Ayal D, da Silva I, eds. African Handbook of Climate Change Adaptation 1-23 p. https://hdl.handle.net/10568/110441

Vietnam

1. **2016:** Butterbach-Bahl K, Sander BO, Pelster D, Díaz-Pinés E. Quantifying Greenhouse Gas Emissions from Managed and Natural Soils. *In:* Rosenstock T., Rufino M., Butterbach-

Bahl K., Wollenberg L., Richards M. (eds) Methods for Measuring Greenhouse Gas Balances and Evaluating Mitigation Options in Smallholder Agriculture. Springer, Cham. https://doi.org/10.1007/978-3-319-29794-1_4

2. **2017:** Azeem Tariq, Quynh Duong Vu, Lars Stoumann Jensen, Stephane de Tourdonnet, Bjoern Ole Sander, Reiner Wassmann, Trinh Van Mai, Andreas de Neergaard. Mitigating CH4 and N2O emissions from intensive rice production systems in northern Vietnam: Efficiency of drainage patterns in combination with rice residue incorporation. *Agriculture, Ecosystems & Environment,* 249:101-111. https://doi.org/10.1016/j.agee.2017.08.011
3. **2017**. Padre, Agnes & Dang Hoa, Tran & Nghia, Hoang & Duong, Hau & Ngan, Tran & Le Van, An & Minh, Ngo & Wassmann, Reiner & Sander, Bjoern Ole. (2017). Measuring GHG Emissions from Rice Production in Quang Nam Province (Central Vietnam): Emission Factors for Different Landscapes and Water Management Practices. DOI: 10.1007/978-981-10-2624-9_7
4. **2017.** Thi Bach Thuong Vo, Reiner Wassmann, Agnes Tirol-Padre, Van Phuong Cao, Ben MacDonald, Maria Victoria O. Espaldon & Bjoern Ole Sander (2018) Methane emission from rice cultivation in different agro-ecological zones of the Mekong river delta: seasonal patterns and emission factors for baseline water management. *Soil Science and Plant Nutrition*, 64:1, 47-58, DOI: 10.1080/00380768.2017.1413926
5. **2018.** Azeem Tariq, Andreas de Neergaard, Lars Stoumann Jensen, Bjoern Ole Sander, Mai Van Trinh, Quynh Duong Vu, Reiner Wassmann, Stephane de Tourdonnet, Co-design and assessment of mitigation practices in rice production systems: A case study in northern Vietnam. *Agricultural Systems*, 167:72-82. https://doi.org/10.1016/j.agsy.2018.08.012. https://www.sciencedirect.com/science/article/pii/S0308521X17311514

6. **2018.** Azeem Tariq, Lars Stoumann Jensen, Bjoern Ole Sander, Stephane de Tourdonnet, Per Lennart Ambus, Phan Huu Thanh, Mai Van Trinh, Andreas de Neergaard, Paddy soil drainage influences residue carbon contribution to methane emissions. *Journal of Environmental Management*, 225:168-176. https://doi.org/10.1016/j.jenvman.2018.07.080. https://www.sciencedirect.com/science/article/pii/S0301479718308430
7. **2018.** Thi Bach Thuong Vo, Reiner Wassmann, Agnes Tirol-Padre, Van Phuong Cao, Ben MacDonald, Maria Victoria O. Espaldon & Bjoern Ole Sander. Methane emission from rice cultivation in different agro-ecological zones of the Mekong river delta: seasonal patterns and emission factors for baseline water management, Soil Science and Plant Nutrition, 64:1, 47-58, DOI: 10.1080/00380768.2017.1413926
8. **2019:** Nguyen-Van-Hung, Sander BO, Quilty J, et al. An assessment of irrigated rice production energy efficiency and environmental footprint with in-field and off-field rice straw management practices. *Sci Rep* 9. https://doi.org/10.1038/s41598-019-53072-x
9. **2019:** Working Paper No. 263. An investment plan for low-emission rice production in the Mekong River Delta region in support of Vietnam's Nationally Determined Contribution to the Paris Agreement.
10. **2020:** MRV Toolbox : MapAWD, SECTOR, Rice-CBA and RiceMo
11. **2020:** Methane Emission Factors from Vietnamese Rice Production: Pooling Data of 36 Field Sites for Meta-Analysis. *Climate*, *8*(6), 74.

References

Better Evaluation. Contribution Analysis. Accessed on 31 May 2021: https://www.betterevaluation.org/en/plan/approach/contribution_analysis

CCAFS (2016). CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) Phase II Proposal 2017-2022 .

FAO and GRA. 2020. Livestock Activity Data Guidance (L-ADG): Methods and guidance on compilation of activity data for Tier 2 livestock GHG inventories. Accessed on 31 May 2021: https://doi.org/10.4060/ca7510en

GRA, CCAFS. 2016. Livestock development and climate change: The benefits of advanced greenhouse gas inventories. Global Research Alliance on Agricultural Greenhouse Gases.

Huppmann D, Kriegler E, Krey V, Riahi K, Rogelj J, Calvin K, et al. 2019. Integrated Assessment Modelling Consortium (IAMC) 1.5°C Scenario Explorer and Data hosted by IIASA. Integrated Assessment Modeling Consortium & International Institute for Applied Systems Analysis, 2019. doi: 10.5281/zenodo.3363345 , url: data.ene.iiasa.ac.at/iamc-1.5c-explorer

IPCC. 2018. The Intergovernmental Panel on Climate Change (IPCC). Global Warming of 1.5°C. Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.) Accessed on 31 May 2021: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf

Mayne J. 2008. Contribution analysis: An approach to exploring cause and effect. Institutional Learning and Change (ILAC) Initiative, ILAC Briefs. 16. https://web.archive.org/web/20150226022328/http:/www.cgiar-ilac.org/files/ILAC_Brief16_Contribution_Analysis_0.pdf

UNFCCC. 2014. Handbook on Measurement, Reporting and Verification for developing country Parties, United Nations Framework Convention on Climate Change (UNFCCC). Accessed on 18 May 2021: https://unfccc.int/files/national_reports/annex_i_natcom_/application/pdf/non-annex_i_mrv_handbook.pdf

UN IAEG-SDGs. 2020. Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development. Accessed on 6 May 2021: https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202020%20review_Eng.pdf

Wilkes A, van Dijk S. 2018. Tier 2 inventory approaches in the livestock sector: A collection of agricultural greenhouse gas inventory practices. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Wilson-Grau R, Britt H. 2013. Outcome Harvesting. BetterEvaluation. Available at: https://www.outcomemapping.ca/download/wilsongrau_en_Outome%20Harvesting%20Brief_revised%20Nov%202013.pdf

Wilson-Grau R. 2015 Outcome Harvesting. BetterEvaluation. Accessed on 31 May 2021: https://www.betterevaluation.org/plan/approach/outcome_harvesting

RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

CGIAR

CCAFS

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) brings together some of the world's best researchers in agricultural science, development research, climate science and Earth system science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. For more information, visit us at **https://ccafs.cgiar.org/.**

Titles in this series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

CCAFS is led by:

Alliance

Bioversity International

CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change

CCAFS research is supported by:

CGIAR

Australian Government
Australian Centre for International Agricultural Research

Irish Aid
An Roinn Gnóthaí Eachtracha agus Trádála
Department of Foreign Affairs and Trade

Ministry of Foreign Affairs of the Netherlands

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Agency for Development and Cooperation SDC

UKaid
from the British people

USAID
FROM THE AMERICAN PEOPLE

IFAD
Investing in rural people